U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

PREPARED IN COLLABORATION WITH:
RUSSIAN ACADEMY OF SCIENCES
GEOLOGICAL SURVEY OF CANADA
ALASKA DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS
RUSSIAN COMMITTEE ON GEOLOGY
MICHIGAN STATE UNIVERSITY
EXXON PRODUCTION RESEARCH COMPANY
UNIVERSITY OF ALASKA
GEOLOGICAL SURVEY OF JAPAN

CIRCUM-NORTH PACIFIC TECTONOSTRATIGRAPHIC TERRANE MAP

By **Warren J. Nokleberg[1], Leonid M. Parfenov[2], James W.H. Monger[3], and Boris V. Baranov[2], Stanislav G. Byalobzhesky[2], Thomas K. Bundtzen[4], Tracey D. Feeney[3], Kazuya Fujita[5], Steven P. Gordey[3], Arthur Grantz[1], Alexander I. Khanchuk[2], Boris A. Natal'in[2], Lev M. Natapov[6] Ian O. Norton[7], William W. Patton[1], Jr., George Plafker[1], David W. Scholl[1], Sergei D. Sokolov[2], Gleb M. Sosunov[6], David B. Stone[8], Rowland W. Tabor[1], Nickolai V. Tsukanov[2], Tracy L. Vallier[1] and Koji Wakita[9]**

Open-File Report 94-714

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

[1] U.S. Geological Survey, [2] Russian Academy of Sciences, [3] Geological Survey of Canada, [4] Alaska Division of Geological and Geophysical Surveys, [5] Russian Committee on Geology, [6] Michigan State University, [7] Exxon Production Research Company, [8] University of Alaska, [9] Geological Survey of Japan

1994

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 94-714
PAMPHLET

CIRCUM-NORTH PACIFIC TECTONOSTRATIGRAPHIC TERRANE MAP

By Warren J. Nokleberg[1], Leonid M. Parfenov[2], James W.H. Monger[3], and Boris V. Baranov[2], Stanislav G. Byalobzhesky[2], Thomas K. Bundtzen[4], Tracey D. Feeney[3], Kazuya Fujita[5], Steven P. Gordey[3], Arthur Grantz[1], Alexander I. Khanchuk[2], Boris A. Natal'in[2], Lev M. Natapov[6], Ian O. Norton[7], William W. Patton[1], Jr., George Plafker[1], David W. Scholl[1], Sergei D. Sokolov[2], Gleb M. Sosunov[6], David B. Stone[8], Rowland W. Tabor[1], Nickolai V. Tsukanov[2], Tracy L. Vallier[1], and Koji Wakita[9]

[1] U.S. Geological Survey, [2] Russian Academy of Sciences, [3] Geological Survey of Canada, [4] Alaska Division of Geological and Geophysical Surveys, [5] Michigan State University, [6] Russian Committee on Geology, [7] Exxon Production Research Company, [8] University of Alaska, [9] Geological Survey of Japan

INTRODUCTION

The companion tectonostratigraphic terrane and overlap assemblage of map the Circum-North Pacific presents a modern description of the major geologic and tectonic units of the region. The map illustrates both the onshore terranes and overlap volcanic assemblages of the region, and the major offshore geologic features. The map is the first collaborative compilation of the geology of the region at a scale of 1:5,000,000 by geologists of the Russian Far East, Japanese, Alaskan, Canadian, and U.S.A. Pacific Northwest. The map is designed to be a source of geologic information for all scientists interested in the region, and is designed to be used for several purposes, including regional tectonic analyses, mineral resource and metallogenic analyses (Nokleberg and others, 1993, 1994a), petroleum analyses, neotectonic analyses, and analyses of seismic hazards and volcanic hazards. This text contains an introduction, tectonic definitions, acknowledgments, descriptions of postaccretion stratified rock units, descriptions and stratigraphic columns for tectonostratigraphic terranes in onshore areas, and references for the companion map (Sheets 1 to 5).

This map is the result of extensive geologic mapping and associated tectonic studies in the Russian Far East, Hokkaido Island of Japan, Alaska, the Canadian Cordillera, and the U.S.A. Pacific Northwest in the last few decades. Geologic mapping suggests that most of this region can be interpreted as a collage of fault-bounded tectonostratigraphic terranes that were accreted onto continental margins around the Circum-North Pacific mainly during the Mesozoic and Cenozoic (Fujita and Newberry, 1983; 1987; Parfenov, 1984, 1991; Howell, 1985; Watson and Fujita, 1985; Parfenov and Natal'in, 1984; Jones and others, 1987; Monger and Berg, 1987, Fujita and Cook, 1990; Zonenshain and others, 1990; Natal'in, 1991, 1993; Moore and others, 1992; Silberling and others, 1992; Nokleberg and others, 1992, 1993, 1994a; Parfenov and others, 1993; Plafker and Berg, 1994; Tabor, 1994).

A key definition for the map is *tectonostratigraphic terrane* which is defined below, along with other key terms, as a fault-bounded geologic entity or fragment that is characterized by a distinctive geologic history that differs markedly from that of adjacent terranes (Jones and others, 1983; Howell and others, 1985). A tectonostratigraphic terrane (hereafter referred to as *terrane*) is a fault-bounded, stratigraphically coherent assemblage that formed before accretion, i.e. tectonic juxtaposition, to adjacent units. A few terranes are fault-bounded structural complexes, mainly subduction zone or accretionary-wedge complexes. The terranes are bounded by various types of major faults or fault zones, termed sutures. Paleontologic, stratigraphic, and paleomagnetic evidence suggests that some terranes were originally widely separated from one another, or from the cratons of either North America or North Asia by distances of as much as thousands of kilometers Plafker and Berg, 1994). But other terranes are interpreted to be displaced from one another or from a another loci on the same continent by distances of only hundreds of kilometers or less.

On the companion map and in the descriptions below, terranes are interpreted according to inferred tectonic environments. These environments are (1) cratonal; (2) passive continental margin; (3) metamorphosed continental margin; (4) continental-margin arc; (5) island arc; (6) oceanic crust, seamount, and ophiolite; (7) accretionary wedge and subduction zone; (8) turbidite basin; and (9) metamorphic for terranes that are too highly-deformed and metamorphosed to determine the original tectonic environment. For terranes with complex geologic histories, the chosen color indicates the tectonic environment most prevalent during this history of the terrane. The tectonic environments inferred for igneous rocks are both temporal and genetic. The temporal environments are preaccretion and postaccretion. The genetic environments are subduction-related, rift-related, and collisional (anatectic)-related.

In addition to terranes, the map also depicts postaccretion units that include: (1) Cenozoic and Mesozoic overlap assemblages of sedimentary and volcanic rocks that are deposited across two or more terranes that formed generally after accretion of most terranes in the region; (2) Cenozoic and Mesozoic basinal deposits that occur within a terrane or on the craton; (3) plutonic rocks. The postaccretion igneous units are identified by age-lithologic abbreviations and by name. These overlap assemblages and basinal deposits formed mainly during sedimentation and magmatism that occurred after accretion of terranes to each other or to a continental margin. Overlap assemblages provide minimum ages on the timing of accretion of terranes. Some Cenozoic and Mesozoic overlap assemblages and basinal deposits, as well as fragments of terranes, are extensively offset by movement along postaccretion faults. In addition, in onshore areas, the map depicts major preaccretion plutonic rocks that are limited to individual terranes, and in offshore areas, the map depicts major oceanic plates, ocean floor magnetic lineations, oceanic spreading ridges, and seamounts.

The map consists of five sheets. Sheets 1 and 2 depict, at a scale of 1:5,000,000, the tectonostratigraphic terranes, preaccretion plutonic rocks, and postaccretion Cenozoic and Mesozoic overlap sedimentary, volcanic, and plutonic assemblages, and basinal deposits for the Circum-North Pacific including the Russian Far East, northern Hokkaido Island of Japan, Alaska, the Canadian Cordillera, part of the U.S.A. Pacific Northwest, and adjacent offshore areas. Sheet 3 provides the list of map units for Sheets 1 and 2. Sheet 4 is a index map showing generalized onshore terranes and overlap assemblages for onshore parts of the Circum-North Pacific at a scale of 1:10,000,000. Sheet 4 is a guide to the more complicated onshore features depicted on Sheets 1 and 2. Sheet 5 is an index map showing the major geographic regions for the Circum-North Pacific.

Significant differences exist between the representation of onshore and offshore geology on Sheets 1 and 2. These are: (1) compared to the onshore part of the map, the offshore part is depicted in a more schematic fashion because of more limited data and because the offshore terranes and early Cenozoic and older overlap assemblages generally are obscured by extensive late Cenozoic sedimentary cover that is not shown unless thicker than two kilometers; (2) marginal contacts of offshore Cenozoic and Cretaceous sedimentary basins do not match contacts of onshore Cenozoic and Cretaceous sedimentary units because offshore basins are limited to those regions with sediment thicknesses greater than two kilometers; (3) stratigraphic columns, included at the end of this explanation, are provided only for onshore terranes because the geology of offshore terranes is generally less well-known; and (4) for simplicity, the major onshore Cenozoic sedimentary basins are generally not defined and described separately because the onshore part of the map is designed to emphasize terranes and overlap volcanic assemblages that are crucial for both for tectonic and metallogenic analyses published elsewhere (Nokleberg and others, 1993, 1994a).

Several key geologic sources were used in the compilation of the map. For Alaska, the basic outcrop pattern for the map is from Beikman (1980), Gehrels and Berg (1992, 1994), Barker and others (1994), Brew (1994), and Moll-Stalcup and others (1994b). The distribution of terranes is from Jones and others (1987) and Monger and Berg (1987), with modifications by Grantz and others (1991), Worall (1991), Nokleberg and others (1993, 1994a), the cited references, and the Alaskan co-authors of this report. For the Canadian Cordillera, the basic outcrop pattern is from Monger and Berg (1987), Wheeler and others (1988), and Wheeler and McFeeley (1991) with modifications by the Canadian authors. For the northern part of the Russian Far East, the basic outcrop pattern is from Sosunov (1985) with modifications by the Russian authors. For the southern part of the Russian Far East, the basic outcrop pattern is from Krasny (1991) and Bazhanov and Oleinik (1986) with modifications by the Russian authors. The Russian Far East part of the map is the first attempt to define and delineate terranes in that region. In their compilation, the Russian authors utilized the methodology of U.S.A. and Canadian geologists. Because this map is the first attempt to display the terranes, Cenozoic and Mesozoic overlap assemblages, basinal deposits, and plutonic belts of the Russian Far East, the Russian authors will appreciate constructive suggestions for improving the map.

TECTONIC DEFINITIONS

The following definitions are modified from Coney and others (1980), Jones and others (1983), Howell and others (1985), Monger and Berg (1987), Wheeler and others (1988), and Wheeler and McFeeley (1991), with modifications by the authors.

Accretion. Tectonic juxtaposition of two or more terranes, or tectonic juxtaposition of terranes to a continental margin.

Accretionary wedge and subduction zone terrane. Fragment of a mildly to intensely deformed complex consisting of varying amounts of turbidite deposits, continental margin rocks, oceanic crust and overlying units, and oceanic mantle. Divided into units composed predominantly of turbidite deposits or predominantly of oceanic rocks. Units are interpreted to have formed during tectonically juxtaposition in a zone of major thrusting of one lithosphere plate beneath another, generally in zones of thrusting along the margin of a continental or an island arc. May include large fault-bounded units with a coherent stratigraphy. On the companion stratigraphic columns, the pattern for accretionary wedge and subduction zone terranes denotes both fragments and matrix in the complex. Many subduction zone terranes contain fragments of oceanic crust and associated rocks that exhibit a complex structural history, occur in a major thrust zone, and possess blueschist facies metamorphism.

Basinal deposits. An assemblage of sedimentary and lesser volcaniclastic and volcanic rocks that were deposited onto a single terrane after accretion, or onto a craton margin or craton after a major orogenic event. Includes some foreland and successor basin deposits, and forearc, intra-arc, and backarc deposits.

Collage of terranes. Groups of tectonostratigraphic terranes, generally in oceanic areas, for which insufficient data exist to separate units.

Craton. Chiefly regionally metamorphosed and deformed shield assemblages of Archean and Early Proterozoic sedimentary, volcanic, and plutonic rocks, and overlying platform successions of Late Proterozoic, Paleozoic, and local Mesozoic and Cenozoic sedimentary and lesser volcanic rocks.

Craton margin. Chiefly Late Proterozoic through Jurassic sedimentary rocks deposited on a continental shelf or slope. Consists mainly of platform successions. Locally has, or may have had an Archean and Early Proterozoic cratonal basement.

Cratonal terrane. Fragment of a craton.

Continental-margin arc terrane. Fragment of an igneous belt of coeval plutonic and volcanic rocks and associated sedimentary rocks that formed above a subduction zone dipping beneath a continent. Inferred to possess a sialic basement.

Foreland basin. Trough or depression filled with clastic deposits that was deposited adjacent to an orogenic belt.

Island arc terrane. Fragment of an igneous belt of plutonic rocks, coeval volcanic rocks, and associated sedimentary rocks that formed above an oceanic subduction zone. Inferred to possess a simatic basement.

Metamorphic terrane. Fragment of a highly metamorphosed or deformed assemblage of sedimentary, volcanic, or plutonic rocks that cannot be assigned to a single tectonic environment because the original stratigraphy and structure are obscured. Includes intensely-deformed structural melanges that contain intensely-deformed fragments of two or more terranes.

Metamorphosed continental margin terrane. Fragment of a passive continental margin, in places moderately to highly metamorphosed and deformed, that cannot be linked with certainty to the nearby craton margin. May be derived either from a nearby craton margin or from a distant site.

Oceanic crust , seamount, and ophiolite terrane. Fragment of part or all of a suite of *eugeoclinal* deep-marine sedimentary rocks, pillow basalt, gabbro, and ultramafic rocks that are interpreted as oceanic sedimentary and volcanic rocks and the upper mantle. Includes both inferred offshore oceanic and marginal ocean basin rocks, minor volcaniclastic rocks of magmatic arc derivation, and major marine volcanic accumulations formed at a hotspot, fracture zone, or spreading axis.

Overlap assemblage. A postaccretion unit of sedimentary or igneous rocks deposited on, or intruded into, two or more adjacent terranes. The sedimentary and volcanic parts either depositionally overlie, or are interpreted to have originally depositionally overlain, two or more adjacent terranes, or terranes and the craton margin. Overlapping plutonic rocks, which may be coeval and genetically related to overlap volcanic rocks, link or stitch together adjacent terranes, or a terrane and a craton margin.

Passive continental margin terrane. Fragment of a craton margin.

Postaccretion rock unit. Suite of sedimentary, volcanic, or plutonic rocks that formed in the late history of a terrane, after accretion. May occur also on adjacent terranes or on the craton margin either as an overlap assemblage or as a basinal deposit. A relative-time term denoting rocks formed after tectonic juxtaposition of one terrane to an adjacent terrane.

Preaccretion rock unit. Suite of sedimentary, volcanic, or plutonic rocks that formed in the early history of a terrane, before accretion. Constitutes the stratigraphy and igneous geology inherent to a terrane. A relative-time term denoting rocks formed before tectonic juxtaposition of one terrane to an adjacent terrane.

Seamount and oceanic plateau. Major marine volcanic accumulations generally formed at a hotspot, fracture zone, or spreading axis.

Subterrane. Fault-bounded unit within a terrane that exhibits a similar but not identical geologic history relative to another fault bounded unit in the same terrane.

Superterrane. An aggregate of terranes that is interpreted to share either a similar stratigraphic kindred or affinity, or a common geologic history after accretion (Moore, 1992). An approximate synonym is *composite terrane* (Plafker, 1990).

Terrane. A fault-bounded geologic entity or fragment that is characterized by a distinctive geologic history that differs markedly from that of adjacent terranes (Jones and others, 1983; Howell and others, 1985). Constitutes a physical entity, i.e., a stratigraphic succession bounded by faults, inferred faults, or an intensely-deformed structural complex bounded by faults. Some terranes may be displaced facies of other terranes.

Turbidite basin terrane. Fragment of a basin filled with deep-marine clastic deposits in either an orogenic forearc or backarc setting. May include continental-slope and continental-rise turbidite deposits, and submarine-fan turbidite deposits deposited on oceanic crust. May include minor epiclastic and volcaniclastic deposits.

CORRELATION OF MAJOR TERRANES AND OVERLAP ASSEMBLAGES AROUND THE CIRCUM-NORTH PACIFIC

The Circum-North Pacific terrane and overlap assemblage map illustrates possible correlations of several groups of terranes and groups of overlap assemblages. In some cases, the correlated units can be traced for several thousand kilometers. In some areas, the original disposition of correlated terranes and overlap assemblages has been obscured by extensive displacement on postaccretion late Mesozoic and Cenozoic strike-slip faults. Together the correlations of terranes and overlap assemblages: (1) constitute interpretations to be further evaluated by additional stratigraphic, geochemical, and isotopic studies; (2) illustrate the possibility of original continuity of rock units around the Circum-North Pacific; and (3) provide important constraints on the past tectonics of the region. The correlations are based principally on comparisons of the stratigraphy, magmatism, metamorphism, and structural history of correlated terranes or overlap assemblages as derived from the stratigraphic columns and written descriptions of units for this map. A subsequent study will present a tectonic model based on these correlations (Nokleberg and others, 1995). Prior correlations of bedrock geology and tectonics between the Russian Far East and Alaska have been published by Box (1985a), Howell (1985), and Parfenov and Natal'in (1985). For Alaska and the Canadian Cordillera, key tectonic analyses have been published by Plafker and others (1989b), Gabrielse and Yorath (1992), Monger and others (1994), and Plafker and Berg (1994).

Passive and Metamorphosed Continental Margin Terranes (Late Proterozoic, Paleozoic, and Early Mesozoic)

Across the northern part of the map is a group of correlated passive continental margin terranes. The Chukotka terrane (Russian Far East), Arctic Alaska superterrane (Alaska), and the Cassiar terrane (Canadian Cordillera) are herein correlated. These terranes constitute a long-lived Late Proterozoic, Paleozoic, and early Mesozoic, Atlantic-type passive continental margin that faced towards a proto-Pacific ocean. The long-lived continental margin includes two periods of continental-margin arc activity, one in the Late Proterozoic, currently recognized only in northern Alaska, and another in the Devonian and Mississippian, recognized in both northern Alaska and the Russian Northeast. The correlation of these terranes represents the extension of the Paleozoic North American continental margin into the Chukotka region of the Russian Northeast.

Outboard of the passive continental-margin terranes, a group of metamorphosed continental margin terranes of Late Proterozoic and Paleozoic age is interpreted as being displaced by a combination of strike-slip and thrust movement from loci along the North American continental margin. The Seward (Russian Northeast and northwestern Alaska), Coldfoot (Northern Alaska), Yukon-Tanana (east-central and southeastern Alaska, and Canadian Cordillera), and the Kootenay (southern Canadian Cordillera) terranes are herein correlated. These terranes are interpreted as fragments of the North American passive continental margin that were penetratively deformed and metamorphosed mainly during from the Late Jurassic and to the mid-Cretaceous during accretion of outboard oceanic terranes, although most of these terranes also contain evidence of Paleozoic deformation and metamorphism. Occurring within both the passive and metamorphosed continental margin terranes are a discontinuous series of granitic plutons and mostly coeval rocks marine volcanic rocks of mainly Devonian and Mississippian age. These igneous rocks are interpreted as a part of an extensive continental-margin arc that formed along the Paleozoic North American continental margin (Rubin and others, 1991).

In southeastern Russia, three groups of terranes can be interpreted as displaced fragments of the North Asian and Sino-Korean cratons. The first group consists of Argun and Gonzha cratonal terranes, the Oldoy passive continental margin terrane, and the Proterozoic to Lower Cambrian part of the Mamyn continental margin arc terrane. Sengör and others (1993) and Sengör and Natal'in (in press) interpret these terranes, as well as similar tectonic units in Transbaikal region of Russia and in Mongolia, as a single strip of the Precambrian continental crust that was rifted off the North Asian (Siberian) craton in the latest Proterozoic. This strip was a back-stop of the Tuva-Mongol arc in the Proterozoic and Paleozoic that evolved into an arc massif. The second group consists of the Baladek cratonal and the Ayan continental margin terranes that contain stratigraphy and rock lithologies that indicate derivation from the Siberian craton. Finally, the third group consists of the Bureya, and Khanka continental margin arc terranes that through regional correlation are interpreted as being derived from North China (Natal'in 1991, 1993; Sengör and others, 1993; Sengör and Natal'in, in press). The Bureya terrane as well as the similar tectonic units of Northeastern China and Inner Mongolia belongs to the Manchurid orogenic system that formed along the north margin of the North China block. The Khanka terrane may be derived from the Korea Peninsula where similar Lower Cambrian shelf carbonates and major sutures exist (Natal'in 1991, 1993). Tectonic separation of the Khanka terrane is interpreted as the result of the Mesozoic strike-slip faulting.

Paleozoic Continental Margin Arc Terranes - Russian Southeast

The Mamyn, Bureya, and Khanka terranes of Southeastern Russia evolved as magmatic arc during the entire Paleozoic. Large, poorly dated, early and late Paleozoic granite and granodiorite intrusions are common to all three units. This feature has been used for combining these terranes into a single unit (Parfenov and Natal'in 1985, 1986; Parfenov, 1984, Zonenshain and others, 1990; Khanchuk, 1993). However, some differences in stratigraphy and the palinspastic reconstruction permits separation as terranes, thereby resulting in the Mamyn, Gonzha, Oldoy, and Argun terranes interpreted as part of the Altaid orogenic system, and the Bureya terrane interpreted as part of the Manchurid orogenic system (Natal'in, 1991, 1993; Sengör and others, 1993; Sengör and Natal'in, in press). Disintegration of both orogenic systems into terranes occurred mainly in the Mesozoic because of escape tectonics process that was initiated by the convergence of Siberia and North China. Paleotectonic reconstructions suggest that the Tuva-Mongol arc, the interpreted origin of the Mamyn, Gonzha, Oldoy, and Argun terranes, was framed by Paleozoic accretionary wedges on both sides. These accretionary wedges, now possibly the Tukuringra-Dzhagdy and Galam terranes, were subsequently removed by strike-slip faulting. The Nora-Sukhotin terrane is interpreted as the accretionary wedge linked to the Bureya terrane. In middle and late Paleozoic, this accretionary wedge was intruded by a magmatic arc migrating toward the paleo-ocean.

Paleozoic and Early Mesozoic Oceanic and Ophiolite Terranes

Outboard of the passive and metamorphosed continental margin terranes is a discontinuous group of correlated oceanic and ophiolite terranes. These terranes are now preserved in subduction-zone complexes that are generally thrust onto the inboard continental margin terranes. The South Anyui and Vel'may (Russian Far East), Angayucham (Alaska), Seventymile (Alaska), and Slide Mountain (Canadian Cordillera) terranes are herein correlated. These terranes are preserved in a series of narrow, discontinuous, and long tectonic lenses. These terranes consist of Paleozoic and early Mesozoic oceanic crustal and upper mantle rocks that are interpreted as having been derived from a large and long-lived proto-Pacific ocean. Parts of these oceanic units were incorporated into subduction zones that formed along the North American margin continental margin. The subduction generally ended by the Jurassic to mid-Cretaceous, depending on the area, with accretion and obduction of the oceanic and ophiolite terranes onto inboard continental margin terranes. Most of the oceanic and ophiolite terranes exhibit an older period of Jurassic or older blueschist facies metamorphism that is correlated with subduction, and a younger period of generally Cretaceous greenschist facies metamorphism that is correlated with extension that occurred after accretion.

Early Mesozoic Island Arc Terranes and Tectonically Paired Accretionary-Wedge and Subduction Zone Assemblages

Outboard of the oceanic and ophiolite terranes are several groups of discontinuous Mesozoic island arc terranes that are correlated and reconstructed into two major successive chain of island arcs across a proto-Pacific ocean. One island arc chain was of Late Triassic and Early Jurassic age, and the other chain was of Jurassic and Early Cretaceous age. Most parts of these island arcs were tectonically paired to outboard subduction-zone or accretionary-wedge terranes.

An older Late Triassic and Early Jurassic chain consists of the Kony-Murgal, Alazeya (Kolyma-Omolon superterrane), and Khetachen (Kolyma-Omolon superterrane) island arc terranes (Russian Far East), and the Stikinia and Quesnellia island arc terranes (east-central Alaska and the Canadian Cordillera). In the Russian Far East, these island arc terranes were tectonically paired to the outboard and coeval Talovskiy and Penzhina-Anadyr accretionary-wedge or subduction-zone complexes. In North America, these island arc terranes were tectonically paired to the Cache Creek and Baker subduction-zone complexes that contains accreted seamounts with Tethyan fauna.

In Russian Southeast, the Uda overlap assemblage, consisting of Uda volcanic belt in the east and the Stanovoy plutonic belt in the west, is interpreted as a tectonic equivalent of this chain (Parfenov and Natal'in, 1977, 1985, 1986; Parfenov, 1984). The magmatic arc rests on the North Asian craton and is paired with the Ulban accretionary wedge terrane and the Uniya-Bom flysch terrane (a former fore-arc basin). Farther south, the magmatic arc occurs in the Great Hinggan Mountains of northeastern China (Natal'in and Borukayev, 1991; Natal'in and Faure, 1991, Natal'in, 1991, 1992; Faure and Natal'in, 1992). At the present, the tectonically-paired accretionary wedge is the Badzhal terrane that was displaced far to the northeast during Cretaceous left-lateral strike-slip faulting.

The western part of the younger Jurassic and Early Cretaceous chain consists of the Oloy-Svyatov Nos and Uyandina-Yasachnaya overlap assemblages (Indigirka assemblage overlapping the Kolyma-Omolon superterrane), and the Zolotogorsky, Nutesyn, and Kony-Murgal island arc terranes (Russian Far East), and the Koyukuk, Nyac, and Togiak island arc terranes (Alaska). In the Russian Far East, these island arc terranes were tectonically paired to the coeval Talovskiy, Penzhina-Anadyr, Pekul'ney, South Anyui, and Vel'may terranes. In the Russian Southeast and Hokkaido Island, the coeval Taukha and Oshima accretionary wedge or subduction zone complexes are tectonically paired to a Late Jurassic and Early Cretaceous igneous arc in Korea.

Jurassic island arcs are absent in the Russian Southeast; however, the Middle Jurassic to earliest Early Cretaceous (Berriasian) Samarka accretionary wedge terrane occurs along the south and central Sikhote Alin Range. Tectonic equivalents of this terrane are: (1) the Tamba-Mino terrane in southeastern Japan (Mizutani, 1987, 1990; Faure and Natal'in, 1989,1992; Kojima, 1989; Natal'in and Faure, 1991; Kojima and others, 1991; Mizutani and Kojima, 1992); (2) the accretionary wedge Oshima terrane of Hokkaido Island that is unconformably overlain by Valanginian andesite and intruded by Early Cretaceous granite (Sugimoto, 1974; Minoura, 1990; Natal'in, 1991, 1993; Natal'in and Faure, 1991, 1992); (3) the Olginsk accretionary wedge terrane that contains large (several kilometers long) bodies of Carboniferous and Permian limestone as melange inclusions (fragments of accreted seamount) that are typical of the Jurassic accretionary wedge terranes of the Sikhote Alin region and Japan. The Olginsk and Taukhinsk terranes of Natal'in (1991, 1993) are herein combined into the Taukha terrane according to Khanchuk (1993). This group of Middle Jurassic to earliest Early Cretaceous accretionary wedge terranes is the loci of the subduction zone that existed along the eastern Asia margin. This subduction zone is tectonically paired to the Jurassic granites of Korea to the southeast, (Lee, 1987; Cluzel, 1991; Cluzel and others, 1991) that are connected by magmatic anomalies with the Jurassic to Cretaceous volcanic-plutonic belt of southeastern China (Ren and others, 1987). The present day disposition of the terranes and numerous Cretaceous left-lateral strike-slip faults indicate a major, northward tectonic transport of the accretionary wedge terranes with respect to the magmatic arc. This eastern Asia magmatic arc and tectonically-paired accretionary wedge terranes are the southern continuation of the Great Hinggan arc (Natal'in, 1991, 1993; Natal'in and Faure, 1991; Faure and Natal'in, 1992).

The Khingan-Okhotsk volcanic-plutonic belt, interpreted as an overlap assemblage, the Kema island arc terrane, and large mid-Cretaceous granitic intrusions in Sikhote Alin Range are fragments of an Early Cretaceous magmatic arc that formed along the eastern Asia margin after collision of the Anyi microcontinent (Anui continental margin terrane and probably the Khor metamorphic terrane) with the Samarka terrane (Natal'in 1991, 1993, Natal'in and Faure 1991, Faure and Natal'in 1992, Natal'in et al., 1995). The Late Jurassic to Early Cretaceous (latest Late Jurassic to Albian) Khabarovsk, Amur River, and Kiselevka-Manoma accretionary wedge terranes are tectonically-paired with the Khingan-Okhotsk volcanic-plutonic belt (Natal'in and Alexeenko; 1989, Natal'in and Zyabrev, 1989). The accretionary wedge units tectonically paired to the Kema arc and equivalent arc rocks in Japan are the Aniva and Tokoro terranes, and the ophiolite, high-pressure schist, and Lower Cretaceous melange of the Sorachi-Edzo turbidite terrane (Dobretsov and others, in press). These terranes evolved throughout the Early Cretaceous. The Taukha terrane may be part of this group but formation ending during the Valanginian to Hauterivian (Golozubov and Melnikov, 1986; Yushmanov, 1986; Mikhailov and others, 1987; Vrublevsky and others, 1987; Khanchuk and others, 1988) due to the detachment from and transportation along transpressional left-lateral strike-slip faults (Natal'in, 1991). The same process may have affected the Tokoro terrane.

The eastern part of the younger Jurassic and Early Cretaceous chain are the Kahiltna sedimentary and volcanic assemblage (southern Alaska), the Gravina-Nutzotin-Gambier volcanic-plutonic-sedimentary belt (eastern-southern Alaska, southeastern Alaska, and the western Canadian Cordillera) that, together with coeval plutonic rocks, form an extensive overlap assemblage on the Wrangellia island arc superterrane. Coeval parts of this chain in the interior and southern parts of the Canadian Cordillera are the Spences Bridge volcanic-plutonic belt, the Tahtsa-Twin Sisters magmatic assemblage, and the Cadwaller, Methow, Izee, and Wallowa island arc and turbidite basin terranes. In Alaska and the Canadian Cordillera, these terranes and overlap assemblages were tectonically paired to the Angayucham, Bridge River, Chugach (McHugh Complex and older part of Valdez Group), and Goodnews terranes, and the older part of the Pacific Rim terrane (accretionary-wedge or subduction-zone complexes). This Late Jurassic and Early Cretaceous island arc ceased igneous activity during accretion in the late Early Cretaceous to the continental margin of North America.

Late Mesozoic and Cenozoic Continental Margin Arcs and Tectonically Paired Accretionary-Wedge and Subduction Zone Assemblages

After major accretions in the Late Jurassic and Cretaceous in both the Russian Far East and the North American Cordillera, a series of elongate Cretaceous and Tertiary continental margin arcs formed around the proto-Pacific ocean. These continental-margin arcs overlapped the previously-accreted terranes. Most of these continental-margin arcs were tectonically paired with outboard subduction-zone or accretionary-wedge terranes. Although the Mesozoic and Cenozoic continental margin arcs and paired subduction-zone and accretionary-wedge complexes occurred along active continental margins, they formed in widely separated continental margins around the Circum-North Pacific and are only coeval arcs, rather than being part of a single continuous arc.

In the mid-Cretaceous, a short period of intense thrusting and subsequent regional extension is interpreted as occurring in the inboard regions of the northeastern part of the Russian Northeast, Alaska, and the Canadian Cordillera. This period of accretion, thrusting, metamorphism, and possible subsequent extension is interpreted as forming the collisional Omineca-Selwyn plutonic belt that extends from the southern Canadian Cordillera through Alaska and into the northeastern part of the Russian Northeast.

Subsequently in the Late Cretaceous and early Tertiary, two elongate continental-margin arcs formed along the margins of the proto-Pacific ocean. Along the northwestern margin of the ocean were the Late Cretaceous and early Tertiary parts of the East Sikhote-Alin and Okhotsk-Chukotka volcanic-plutonic belts in the Russian Far East. Along the northeastern margin of the ocean was the Late Cretaceous and early Tertiary Kluane arc in southwestern, southern, and southeastern Alaska, and in the Canadian Cordillera.

In the Late Cretaceous, the Okhotsk-Chukotka and East Sikhote-Alin, Early Tertiary Kamchatka-Koryak, and the Late Eocene to Quaternary Central Kamchatka volcanic belts formed igneous arcs that were tectonically paired with various forearc basins and accretionary wedge complexes. The Okhotsk-Chukotka and East Sikhote-Alin belts were paired with the Ekonay, Yanranay and Nabilsky accretionary wedge complexes. The Albian to Late Cretaceous Penzhina and West Sakhalin sedimentary basins are interpreted as forearc basins for these igneous arcs. The Kamchatka-Koryak igneous arc was tectonically paired with the West Kamchatka accretionary wedge complex. The Central Kamchatka igneous arc faced towards the Pacific Ocean and was tectonically paired with the Central Kamchatka forearc basin, and the Vetlovskiy accretionary wedge terrane. At the same time, the outboard and coeval, Late Cretaceous to Early Tertiary Nemuro (lesser Kuril), Kronotskiy, Stolbovskoy, and Olyutorka-Kamchatka island arc terranes are interpreted as parts of a single island arc that was tectonically paired to the Kuril (older part) accretionary- wedge and subduction-zone complex.

In Alaska, the Canadian Cordillera, and the U.S.A. Pacific Northwest, the Kluane continental-margin arc consisted of the Kuskokwim Mountains sedimentary, volcanic, and plutonic belt (and related Alaska Range-Talkeetna Mountains and Yukon-Kanuti igneous belts), the Coast-North Cascade plutonic belt. The continental-margin Kluane arc was tectonically paired with the younger parts of the Chugach (Valdez Group) and Pacific Rim terranes, and the older part of the Prince William terrane (accretionary-wedge and subduction-zone complexes).

In the early Tertiary (Eocene) three major continental margin arcs formed around the Circum-North Pacific. In addition, the early Tertiary Shirshov Ridge and Bowers Ridge volcanic belts formed a short-lived continental-margin arcs in the Bering Sea. In the Russian Far East were the east Kamchatka and Kamchatka-Koryak volcanic belts. These arcs and volcanic belts were tectonically paired to the outboard Kuril-Kamchatka and West Kamchatka (Ukelayat subterrane) terranes (accretionary-wedge and subduction-zone complexes). In Alaska were the interior Alaska volcanic belt, the Aleutian volcanic arc, and the Wrangell volcanic field. This continental margin arc was tectonically paired with the younger part of the Prince William terrane, and the Yakutat terrane (accretionary-wedge and subduction-zone complexes). In the Canadian Cordillera and the U.S.A. Pacific Northwest, the Cascade volcanic-plutonic belt was tectonically paired to the Siletzia, Olympic Core, and Hoh terranes (accretionary-wedge and subduction-zone complexes).

From the Miocene through the present, three continental margin arcs have been active around the Circum-North Pacific. In the Russian Far East and Hokkaido Island, the East Japan volcanic belt, the Kuril volcanic arc, the central Kamchatka volcanic and sedimentary basin, and the east Kamchatka volcanic belt are tectonically paired to: (1) the Kuril-Kamchatka subduction-zone complex; and (2) the Sea of Japan and the Kuril back-arc units. In Alaska, the Aleutian volcanic arc and the Wrangell volcanic field are tectonically paired to a subduction-zone complex that is inboard of the Aleutian megathrust. In the southern Canadian Cordillera and the U.S.A. Pacific Northwest, the Cascade volcanic-plutonic belt is tectonically paired to: (1) a subduction zone complex that is inboard of the Cascadia megathrust; and (2) the Columbia River Basalt Group that forms a coeval back-arc unit.

PALEOMAGNETIC DATA FOR RUSSIAN FAR EAST, ALASKA, AND CANADIAN CORDILLERA

Notes on the Paleomagnetic Data Selection

All data available in the literature were compiled and graded according to the selection criteria listed below. For Northeastern Russia, much of the data is from the compilations of Khramov as reported in the global paleomagnetic data base by Lock and McElhinny (1991). Each data set was assigned a grade between A (very good) and D (marginal). All other data in the literature were rejected until such time as positive magnetic stability tests of some type are available. The complete compilation of the paleomagnetic data is available from D.B. Stone.

The selection criteria for Grades A through D are:

Grade A: Multiple demagnetization steps must have been applied to most or all of the samples, and statistically good fold or reversal tests are quoted, though in some cases other evidence of a positive stability test was accepted (e.g. a conglomerate test or a baked contact test).

Grade B: Multiple demagnetization steps have been applied to a significant number of the samples, and the author claims to have established positive stability for the magnetization.

Grade C: Single level, blanket demagnetization techniques have been applied, and the author claims positive stability tests but gives no supporting data, or, normal and reversely magnetized samples are combined without any quantitative evidence that the magnetizations are antipodal. Grade C was also assigned to cases where ancient horizontal was poorly constrained, as for instance for data from intrusive rocks.

Grade D: The author claims to have data that represent the paleomagnetic· magnetic field, but gives no supporting evidence. Grade D is also used for cases where the data are apparently *clean*, but where normal stability tests are not possible.

The displacements quoted are the latitudinal displacements of the paleomagnetic poles for the localities sampled with respect to the Siberian Platform for the Northeastern Russian data, and the North American poles for Alaska and Canada. The Siberian Platform composite apparent polar wander path (APWP) for pre-Triassic time is taken from Khramov (1991) who used data directly related to the craton. For the Triassic to the present, the APWP of Besse and Courtillot (1991) is utilized. This latter APWP is based on paleomagnetic pole position data from many places rotated into the reference frame of the Siberian platform using paleogeographic reconstruction poles. The North American polar wander path is taken from Van der Voo (1993) for Paleozoic and earlier times, and from Besse and Coutillot (1991) from Triassic time to the present. The majority of displacements are southerly with respect to either the Siberian platform or North America. Northerly displacements are listed as negative.

ACKNOWLEDGMENTS

We thank the many geologists who have worked with us for their valuable expertise in each region of Alaska, the Russian Far East, Hokkaido Island of Japan, the Canadian Cordillera, and the U.S.A. Pacific Northwest. In particular we thank J.N. Aleinikoff, Yu.V. Arkhipov, H.C. Berg, R.B. Blodgett, S.E. Box, D.A. Brew, M.D. Bulgakova, Ch. B. Borukayev, D.C. Bradley, Howard Brooks, J. Decker, Cynthia Dusel-Bacon, H.L. Foster, V.V. Gaiduk, B.M. Gamble, V.V. Golozubov, D.G. Howell, D.L. Jones, S.M. Karl, S.V. Kovalenko, W.C. McClelland, E.M. MacKevett, Jr., A.V. Makhinin, M.V. Martynyuk, M.L. Miller, T.P. Miller, L.Ph. Mishin, E.J. Moll-Stalcup, T.E. Moore, S.W. Nelson, V.S. Oxman, S.A. Palanjan, I.V. Panchenko, T.L. Pavlis, L.I. Popeko, A.V. Prokopiev, J.C. Reed, Jr., D.H. Richter, S.M. Roeske, V.I. Shpikerman, N.J. Silberling, T.E. Smith, A.B. Till, F.F. Tret'yakov, A.N. Vishnevskiy, I.G. Volkodav, W.K. Wallace, G.R. Winkler, L.P. Zonenshain, and Yu.P. Zmievsky for their many fruitful discussions. We thank Ch.B. Borykayev, the late William R. Greenwood, Donald Grybeck, B.A. Morgan III, I.Ya. Nekrasov, A.T. Ovenshine, P.P. Hearn, A.A. Sidorov, T.E. Smith, D.J. Templeman-Kluit, and W.H. White for their encouragement and support of the project. We thank Russian interpreters Lidiya I. Kovbas, Tatyana L. Koryakina, Tatyana N. Velikoda, and Elena V. Alekseenko for their skill and assistance during long and complex scientific dialogues, and for translation of complex geologic descriptions and references. We thank Stephen G. Crumley for compilation of paleomagnetic data, C.J. Nokleberg for computer drafting of many of the stratigraphic columns, and J.A. Nokleberg for coloring of review copies of the map. We also thank George W. Moore and Thomas E. Moore for their constructive reviews.

DESCRIPTIONS OF MESOZOIC AND CENOZOIC OVERLAP SEDIMENTARY AND VOLCANIC ASSEMBLAGES, AND BASINAL DEPOSITS

[Arranged alphabetically by map symbol; abbreviations for map symbols displayed in parentheses on map where space permits]

al **Aleutian arc (early Tertiary to Holocene) (Alaska Peninsula, Aleutian Islands, and Komandorsky Islands, units QTvf, QTvm, QTpf, mTvf, mTvm, mTpf, mTpm)**--Major volcanic arc extending across southern Bering Sea from the Kamchatka Peninsula to Alaska. The western part of the arc in the Aleutian Islands is built on oceanic crust, and is subdivided into lower (37 to 55 Ma), middle (5.3 to 37 Ma), and upper series (5.3 Ma to Holocene) (Scholl and others, 1992; Miller and Richter, 1994; Vallier and others, 1994). The lower series forms the base of the arc and consists predominantly of flows and volcaniclastic rocks. Igneous composition ranges from basalt to rhyolite, but is mainly calc-alkalic basalt and andesite. In the Aleutian Islands, the lower series is generally metamorphosed to greenschist through zeolite facies. Common associated with local hypabyssal and plutonic rocks.

The middle series is predominantly volcanic flow and volcaniclastic rocks, conglomerate, and dolomite. Igneous compositions are mainly andesite and dacite. The unit forms an extensive sediment and volcanic blanket on both forearc and backarc slopes. Associated with locally abundant associated sills, dikes, plugs, and large quartz diorite and granodiorite plutons.

The upper series is predominantly sedimentary and volcanic strata in offshore basins and along the flanks of volcanoes. The early Tertiary part of arc, named the Meshik arc on the Alaska Peninsula, consists chiefly of andesite and dacite flows and volcaniclastic rocks. The younger, middle Tertiary through Holocene part of the arc consists of about 37 subaerial stratocones composed predominantly of calc-alkalic andesite to dacite flows, tuffs, and volcaniclastic rocks.

The eastern part of the arc on the Alaska Peninsula and in the Alaska Range is built mainly on the Peninsular sequence of the Wrangellia superterrane (unit WRP). It consists of the 50 to 55 Ma Teklanika Formation and the 37 to 45 Ma Mount Galen, Sheep Creek, and Post River volcanic complexes and associated unnamed units that range in composition from basalt to rhyolite. Characterized by mantle-derived, high-alumina, calc-alkalic suite of igneous rocks. This part of the arc consists of the eroded remnants of stratovolcanos.

The western extremity of the arc in the Komandorsky Islands consists of: (1) Eocene and Miocene volcanic, tuffaceous, and sedimentary deposits including basalt, andesite-basalt and andesite and interbedded tuff (K-Ar ages of 37± 4 Ma); (2) overlying conglomerate with volcanic rock pebbles; (3) interlayered sandstone, tuff, clay mudstone, and diatomite of the Oligocene Kamenskaya suite with local coal layers and plant detritus; (3) unconformably overlying, thin subalkalic basalt and alkalic basal; (4) middle Miocene tuff and tuffaceous siltstone; and (5) cross-bedded sandstone and gritstone. The younger part of the arc locally contains extensive interlayered Quaternary and Holocene glacial deposits.

For paleomagnetic determinations, a sequence of Paleocene sedimentary rocks on the Komandorsky Islands yield grade A results and indicate a southerly displacement with respect to the Siberian platform of $23^{o} \pm 7^{o}$. Sedimentary rocks of Eocene age from two locations on Amlia and Umnak Islands yield grade A results. They indicate a zero displacement with respect to North America within their error limits. **REFERENCES**: Gilbert and others, 1976; Decker and Gilbert, 1977; Bundtzen and others, 1982; Stone and others, 1983; Ivashchenko and others, 1984; Wilson, 1985; Harbert, 1987; Tsvetkov and others, 1990;. Moll-Stalcup, 1990, 1994; Bazhenov and others, 1992; Vallier and others, 1994

am **Alpha-Mendeleev Ridge (Late Early Cretaceous to Paleogene) (Arctic Ocean, Chukchi Sea, and adjacent areas, unit TKvm)**--Consists chiefly of remarkably homogeneous crust that, on the basis of magnetic, gravity, and seismic-refraction data, is as much as 38 km thick at the ridge crest. Magsat data show that the ridge forms one of strongest magnetic anomalies on Earth and may be a volcanic edifice. Magsat data suggest that the highly magnetic rocks of Alpha Ridge continue into the Mendeleev Ridge, where they thin and wedge out near the continental margin of the East Siberian Sea. Four cores and a dredge sample from the North American end of the Alpha Ridge show that the crust is overlain by a few hundred meters of sediment that includes Campanian-Maastrichtian black organic mud and Maastrichtian-Eocene biosiliceous ooze. In one area near the ridge crest, the sedimentary section contains Paleocene and Eocene volcaniclastic alkalic basalt that was erupted within a few hundred meters of the sea floor. Basalt chemistry suggests formation at a within-plate hotspot, but the composition and tectonic character of the homogeneous part of the ridge is unknown. **REFERENCES:** Taylor, 1983; Jackson, 1985; Mudie and others, 1986; Weber, 1986; Van Wagoner and others, 1986

an **Aniva sedimentary basin (Cenozoic) (Southern Sea of Okhotsk, unit Czs)**--Consists chiefly of Miocene to Quaternary sedimentary rocks with thickness of up to 3 to 4 km. Seismic data indicate sedimentary rocks occur in two units, an upper subhorizontal unit, and a lower more deformed unit that fills irregularities in the surface of acoustic basement. The basin overlaps the suture separating the Academy of Sciences and Institute of Oceanology collages. **REFERENCES**: Baboshina and others, 1984; Gnibidenko and Khvedchuk, 1984; Kudelkin and others, 1986

as **Amerasia sedimentary basin (Early Cretaceous to Quaternary) (Canadian Arctic Islands and Beaufort Sea, unit TJs)**--Basin, part of which is outside of map area, is separated into two parts by the large, bathymetrically irregular Alpha-Mendeleev ridge system. The northern part of the Amerasia basin is the Makarov basin that occurs between the Alpha-Mendeleev ridge and the Lomonosov Ridge. The southern part is in the Beaufort Sea area between the Alpha-Mendeleev ridge and North America. Adjacent to Wrangel Island and the Chukchi shelf, the Amerasia basin contains a cluster of north-trending, high-standing, flat-topped ridges separated by narrow, north-trending sedimentary basins. These ridges constitute the Chukchi continental borderland and are assigned to the Northwind ridge, Chukchi cap, and Arlis terranes that are inferred to consist of continental crust and continental margin rocks. The crust of the Amerasia basin is best from seismic-refraction and multichannel seismic-reflection data that indicate that the thickness of oceanic layer 3 may range from 4.4 to 6.7 km, and that oceanic layer 2 is probably less than 2 km thick.

Subsurface geologic and seismic-reflection data from the North Slope of Alaska and the Alaskan Beaufort Sea shelf suggest that this region (Canada Basin) opened in two stages. Opening began in the Early Jurassic when a series of rifts of unknown width, in part preserved beneath the Beaufort shelf and slope, formed between Arctic Alaska and the Canadian Arctic Islands. The clastic sedimentary section in these rifts is inferred from seismic data to range from Early Jurassic to Neocomian. Renewed rifting in the late Hauterivian led to continental breakup and the initiation of seafloor spreading to form the basin. Cessation of spreading is not known but probably occurred during the mid- to Late Cretaceous. Oceanic crust beneath the basin in this area is interpreted as forming mainly between the Hauterivian and mid- to Late Cretaceous.

The Hauterivian or Barremian to Holocene sedimentary rocks (layer 1) range in thickness from about 6 km to the northwest to more than 12 km to the southeast. Seafloor morphology, basin-fill geometry, and seismic-reflection character suggest that these sedimentary rocks consist of turbidite deposits derived primarily from the Mackenzie delta and the Canadian Arctic Islands, with minor contributions from the Alaskan Beaufort Sea and Chukchi Sea shelves. Reflection character and tentative extrapolation of continental shelf stratigraphy into the basin suggest that, beneath the continental rise north of the central part of the North Slope of Alaska, the Cretaceous section in the basin is more than 3.5 km thick, the Tertiary section is 3.0 to 3.5 km thick, and the Quaternary section is 1.2 km thick. The Quaternary section locally thickens to about 1.5 km the west.

Seismic-reflection and gravity data from the Wrangel Island Abyssal Plain indicates that the sedimentary section in the southern part of the Amerasia Basin, west of the Alpha-Mendeleev Ridge, consists of turbidite deposits that are more than 3.5 km thick. Gravity modeling suggests that the sedimentary rocks may be about 6 km thick and overlie oceanic crust 5 to 7 km thick. **REFERENCES:** Kutschale, 1966; Mair and Lyons, 1981; May and Grantz, 1990; Grantz and others, 1990; Grantz and May, 1983

at **Alaska Range-Talkeetna Mountains volcanic-plutonic belt (Late Cretaceous and early Tertiary) (Southern Alaska, units TKvi, TKpi, TKps)**--Occurs in an elongate, northwest-trending arc for several hundred kilometers, mainly south of Denali fault. Consists chiefly large and small volcanic fields composed of rhyolite, dacite, and andesite flows, pyroclastic rocks, and interlayered basalt and andesite flows. Volcanic rocks yield 50 to 75 Ma ages and calc-alkalic compositional trends (Moll-Stalcup, 1990, 1994). Belt also contains numerous related diorite, quartz diorite, granodiorite, and granite and locally monzonite and syenite plutons. Belt is partly coeval with Kuskokwim Mountains sedimentary, volcanic, and plutonic belt (unit km) to north in interior Alaska. Alaska Range-Talkeetna Mountains volcanic-plutonic belt forms part of Kluane arc of Plafker and others (1989b), and is correlated with Coast-North Cascade plutonic belt (unit cn) in east-central Alaska and the Canadian Cordillera. The Alaska Range-Talkeetna Mountains belt overlies the Dillinger, Peninsular, and adjacent terranes, and the Kahiltna assemblage. For paleomagnetic determinations, three different sequences of extrusive volcanic rocks yield grade A results, and one yields grade C results. The ages of sampled units range from Paleocene to Eocene. The grade C results and one grade A result indicate no displacement for 42 and 60 Ma rocks, respectively. The other two localities, also 40 and 60 Ma, yield small northward displacements with respect to North America. **REFERENCES**: Hillhouse and Gromme, 1982; Hudson, 1983; Hillhouse and others, 1985; Panuska and Macicak, 1986; Stamatakos and others, 1988; Panuska and others, 1990; Moll-Stalcup, 1994; Moll-Stalcup and others, 1990, 1994; Plafker and others, 1989b

atb **Aleutian-Bowers sedimentary basin (Cenozoic) (Northern Pacific and Bering Sea, unit CzKs)**—Consists chiefly of sedimentary hemipelagic and clastic deposits of Eocene and younger age. Overlies igneous and sedimentary rocks of the Aleutia terrane. Thickness ranges from 2,000 to 12,000 m. Thickest deposits fringe the southern margin of the Bering Sea in the area north of the Aleutian arc. **REFERENCES:** Cooper and others, 1987, 1992; Scholl and others, 1992

bg **Blagoveshchensk sedimentary basin (Late Cretaceous? to Quaternary) (East Siberian Sea, unit CzKsv)**—Inferred to contain Late Cretaceous to Quaternary sedimentary rocks on the basis of extrapolation from the Asian continent. Sediment thicknesses, based on potential field geophysical data, is interpreted as 4 to 5 km thick, perhaps deeper in the southern part. **REFERENCES:** Volk and Gaponenko, 1981; Kos'ko, 1984; 1988; Volk and others, 1984; Fujita and Cook, 1990

bo **Bowser sedimentary assemblage (Middle Jurassic (Bathonian) to Early Cretaceous (Albian) (Central and southern Canadian Cordillera, unit KJs)**—Consists chiefly of siltstone, shale, sandstone and conglomerate representing mainly shallow-marine, deltaic and nonmarine clastic rocks of the Bowser Lake Group. These rocks generally grade upward from marine to nonmarine (Eisbacher, 1974; Evenchick, 1991 a, b). Bowser assemblage interpreted as a foreland basin deposited on Stikinia terrane. Most of the detritus in the Bowser assemblage is derived from the Cache Creek terrane to the north and east (Gabrielse, 1991). The Bowser Lake Group is underlain by the fine-grained clastic Toarcian to Aalenian Spatzizi Group, which is composed mainly of shale with minor volcanic rocks, and may represent a pre-Bowser starved basin sequence that reflects the Early to Middle Jurassic accretion of Cache Creek terrane to the eastern margin of the Stikinia terrane. **REFERENCES**: Eisbacher, 1974; Evenchick, 1991a, b; Gabrielse, 1991; Ricketts and others, 1992

bs **Bering Sea volcanic belt (late Tertiary and Quaternary) (Bering Sea, Seward Peninsula, and Southwestern Alaska, unit QTvm)**—Consists chiefly of voluminous, highly alkalic and olivine tholeiite basalt flows, cones, and maars mostly of Holocene to 6 Ma age (Moll-Stalcup, 1990, 1994). Includes widespread alkalic basalt flows, cinder cones, plugs and maar craters on Seward Peninsula of Holocene to 28 Ma age. Contains local analcime- or nepheline-bearing basanite or nephelinite flows. Unit displays high alkali and low silica compositional trends. Occurs in west-central Alaska and adjacent offshore islands. Overlies Seward, Angayucham, Koyukuk, and adjacent terranes. For paleomagnetic determinations, extrusive volcanic rocks sampled on two Bering Sea islands (Pribilof and Nunivak Islands), with ages of less than 2 and 6 Ma, respectively, show no displacements. **REFERENCES**: Hoare and others, 1968; Moll-Stalcup, 1990, 1994; Moll-Stalcup and others, 1994

bu **Bureya sedimentary basin (Early Jurassic (Pliensbachian) to Early Cretaceous - Albian) (Northwestern part of Russian Southeast, unit KJs)**—Consists chiefly of Jurassic and Cretaceous shallow-marine and nonmarine sandstone, siltstone, and shale. Early and Middle Jurassic section mainly marine. Late Middle Jurassic (Callovian) transition to nonmarine deposition. Interlayered coal deposits in Late Jurassic and Early Cretaceous part of section. Felsic tuff is intercalated throughout Jurassic section. Sedimentary rocks are weakly to undeformed in the western part of the basin, but are folded and faulted in the eastern part of the basin. Sedimentary rocks of the basin unconformably overlie the Turan and Malokhingansk terranes of the Bureya superterrane. **REFERENCE**: Krasny and others, 1966; Kozlovsky, 1988

bw **Bowers Ridge volcanic belt (early Tertiary?) (Bering Sea, unit Czv)**—Consists chiefly of intermediate composition volcanic rocks, mainly altered andesite, breccia, volcaniclastic sedimentary rocks, and lesser diatomaceous siltstone. Sparse dredge samples and DSDP drilling suggest a Miocene age for the volcanic rocks. A trench filled with as much as 12 km of sedimentary rocks is located at the base of the northern and eastern slopes of Bowers Ridge suggesting that the unit formed in an early Tertiary arc-trench system that faced toward the northeast. **REFERENCES:** Cooper and others, 1992; Scholl and others, 1992

ca **Cascade volcanic-plutonic belt (late Eocene to Quaternary) (Central and southern Canadian Cordillera, and U.S.A. Pacific Northwest, units QTvi, QTvm, mTp)**—In Canadian Cordillera, belt consists of Pleistocene-Holocene basalt, andesite, and dacite eruptive centers, and late Eocene(?), Oligocene, and Miocene plutons (Chilliwack and Mount Barr batholiths). Includes age-equivalent, possibly unrelated volcanic rocks (Masset Formation) on the Queen Charlotte Islands..

In U.S.A. Pacific Northwest, the belt consists of volcanic rocks of stratovolcanoes, mostly andesite but ranging from basalt to rhyolite. Includes interbedded fluvial and lacustrine deposits and minor tonalite to granodiorite plutons. In Washington, parts of belt are included in the Ohanapecosh, the Fifes Peak, and the Northcraft Formations (Walsh and others, 1987; Vance and others, 1987; Smith, 1993). The Oregon parts of belt are included in many formations and informal units, listed in Walker and MacLeod (1991). Youngest active volcanoes include Mount Jefferson, Mount Hood, Mount Adams, Mount St. Helens, and Mount Rainier. The Cascade belt comprises the western part of unit QTvi in Washington and Oregon. East of the volcanoes, the belt includes units that are interpreted as backarc extensional volcanic rocks of Miocene to Holocene age, predominantly basaltic and rhyolitic volcanic rocks. **REFERENCES**: MacLeod and others, 1976; Green, 1981; Walsh and others, 1987; Vance and others, 1987; Wells, 1990; Walker and MacLeod, 1991; Smith, 1993

cb **Columbia River Basalt Group (Miocene) (U.S.A. Pacific Northwest and southern and central Canadian Cordillera, unit QTvm)**—Consists chiefly of thick flows of olivine tholeiite erupted as flood basalt, between 16.5 and 6 Ma, and minor interbeds of fluvial and lacustrine sedimentary rocks. Basalt in group has an estimated volume of 210 km^2 (Swanson and Wright, 1978). Group forms most of unit QTvm in Washington and northern Oregon (Hooper and Conrey, 1989; Hooper 1982; Wells and others, 1989).

In southern Canadian Cordillera, group consists of Chilcotin volcanic field of late Tertiary, mainly

Oligocene(?), Miocene, and Pliocene age (16 to 2 Ma). Mainly subaerial, rarely subaqueous, olivine basalt flows, intercalated pyroclastic rocks, and local gabbroic and basaltic intrusions (Bevier, 1983; Mathews, 1988). Volcanic field also locally contains younger volcanic centers of intermediate to felsic composition, such as the plume-related(?) Anaheim volcanic rocks, and the rift-related Ediza volcanic rocks (Wheeler and McFeely, 1991). Columbia Group interpreted as a back-arc basin tectonically paired to the Cascade volcanic-plutonic belt. **REFERENCES**: Swanson and Wright, 1978; Bevier, 1983; Mathews, 1988; Hooper and Conrey, 1989; Hooper 1982; Wells and others, 1989; Wheeler and McFeely, 1991

cf **Cordilleran sedimentary foreland basin (Late Jurassic-early Tertiary) (U.S.A. Pacific Northwest and Canadian Cordillera, unit TJs)**—Consists chiefly of westerly derived clastic wedges of sandstone, conglomerate, shale, coal, and minor volcaniclastic rocks of Jurassic, Early Cretaceous, mid-Cretaceous and Late Cretaceous to Paleocene age. Older parts of basin grade eastward into marine shale. Only older western parts of basin that stratigraphically overly and are structurally imbricated with Proterozoic to Jurassic cratonal margin rocks are depicted on map. Younger eastern parts of basin, that are deposited on thin Paleozoic to early Mesozoic strata overlying Early Proterozoic crystalline cratonic rocks, are not depicted on map but extend across much of the North American craton on the map. **REFERENCE**: Wheeler and McFeely, 1991

ch **Charlie sedimentary basin (Cenozoic) (Beaufort Sea, Chukchi Sea, and adjacent area, unit Czs)**—Consists chiefly of Cenozoic sedimentary rocks. Bathymetry and gravity modeling suggest that basin ranges from exceeding 2,200 m deep to the south to 3,000 m deep to the north where it merges with the Mendeleev Abyssal Plain and is underlain by oceanic or attenuated continental crust. Seismic-reflection data also indicate sedimentary prism in Charlie Basin is more than 2 km thick. **REFERENCE:** Hall, 1970

ck **Central Kamchatka volcanic and sedimentary basin (Oligocene to Holocene) (Kamchatka Peninsula, unit Czs)**—Consists chiefly of late Pliocene and Quaternary volcanic and sedimentary rocks up to 5 km thick and ranges from 20 to 70 km wide and 350 km long. Basin contains mainly shallow-marine sedimentary rocks up to 6,000 m thick, and widespread tuff, basalt, and basaltic andesite. Unit overlies deformed Late Cretaceous to early Tertiary sedimentary rocks. Basin interpreted as forearc unit for central Kamchatka volcanic belt (unit kc). **REFERENCES**: Vlasov, 1964; Shapiro and others, 1987

co **Colville sedimentary basin (Cretaceous and Cenozoic) (Northern Alaska, unit Ks)**—Consists chiefly of a long-lived Jurassic, Cretaceous, and Paleogene succession of marine sedimentary rocks that extends for about several hundred km across northern Alaska, north of the Brooks Range. Consists of: (1) a proto-Colville basin sequence that consists of the Early Cretaceous Okpikruak, Ogotoruk, Telavirak, Kisimilok Formations; and (2) Colville basin sequence of Cretaceous Fortress Mountain Formation, Bathtub Graywacke, Torok Formation, Nanushuk Group, Hue Shale, Colville Group, Canning Formation, Sagavanirktok Formation, and Gubik Formation. Major units depicted on stratigraphic columns for various terranes of Arctic Alaska superterrane (unit AAN). Various major sedimentary cycles are distinguished. Distribution of megacycles, and paleocurrent and seismic data indicate that the Colville basin sequence was filled longitudinally as sediment prograded from the west toward the northeast in the late Early Cretaceous, and onward onto the eastern North Slope in the Late Cretaceous and Cenozoic. Compositional change interpreted as related to progressive unroofing of terranes to the south. **REFERENCES:** Mull, 1985; Moore and others, 1992

cok **Central Okhotsk sedimentary basin (Cenozoic) (Sea of Okhotsk, unit Czs)**—Consists chiefly of a Pliocene to Quaternary sedimentary basin that is up to 4 km thick. Contains an upper subhorizontal unit and unconformably underlying lower unit that fills narrow grabens. **REFERENCE**: Baboshina and others, 1985

cm **Carmacks volcanic field (Late Cretaceous) (Northern Canadian Cordillera, unit Kv)**—Consists chiefly of nonmarine, alkalic, mainly porphyritic andesite flows and pyroclastics rocks. Contains subordinate rhyolite, trachyte, and dacite in lower part, and basalt in upper part. For paleomagnetic determinations, grade A data from 70 Ma extrusive volcanic rocks indicate a $16^{o}\pm5^{o}$ southerly displacement with respect to North America. **REFERENCE**: Marquis and Globerman, 1988; Wheeler and McFeely, 1991 cn **Coast-North Cascade plutonic belt (Late Cretaceous-early Tertiary) (East-Central Alaska, southeastern Alaska, western Canadian Cordillera, and northern U.S.A. Pacific Northwest, units Kpf, TKpf, Tpf)**—Consists chiefly of a major granitic plutonic belt that extends the full length of the Canadian Cordillera from latitude 49° to 62° N. Also present in the metamorphic core and eastern part of North Cascade mountains as far south as latitude 48° N, and in east-central Alaska. Consists chiefly of quartz diorite, granodiorite, and locally more mafic or felsic plutons. Crystallization ages generally younger toward the east. In the central and southern parts of the belt, age zonation permits division into three subbelts: (1) mid-and Late Cretaceous plutons (about 96-70 Ma); (2) plutons that straddle the Cretaceous-Tertiary boundary (70 to 60 Ma); and (3) early Tertiary plutons (60-40 Ma). Coeval to these three belts are units of intermediate to felsic volcanic and minor plutonic rocks that are exposed locally to the east in the Intermontane Belt of the Canadian Cordillera (Armstrong, 1988; Wheeler and McFeeley, 1991; van der Heyden, 1992; Woodsworth and others, 1991). The northern part of the Coast-North Cascade belt (north of latitude 54° N) consists chiefly of latest Cretaceous and earliest Tertiary (83-57 Ma), and early Tertiary granitic rocks (51-48 Ma) (Gehrels and others, 1990; Wheeler and McFeely, 1991).

Early Late Cretaceous through early Tertiary intrusions were emplaced concurrently with structures formed sequentially during contraction, local(?) dextral transpression and transtension, and accompanied by regional metamorphism (Rubin and others, 1990; Journeay and Friedman, 1993). Together, the plutonic belt and associated structure and metamorphism define the gemorphologic Coast-North Cascade plutonic belt. Intrusion of the early Late Cretaceous granitic rocks of this belt postdates the accretion of the Stikinia, Yukon-Tanana, and Quesnellia terranes that were unequivocally linked to the outboard Wrangellia superterrane by intrusion of this plutonic belt.

In U.S.A. Pacific Northwest, plutonic belt consists chiefly of abundant deep-seated tonalite to granodiorite plutons with minor paragneiss and schist, variously metamorphosed in Late Cretaceous to middle Eocene regional metamorphism. Protoliths of the metamorphosed supracrustal rocks are probably correlative to parts of the Chelan Mountains terrane and in part to the Bridge River terrane. In U.S.A. Pacific Northwest and in southernmost British Columbia, belt includes most of the Skagit Metamorphic Complex (Misch, 1966; Haugerud, 1991).

In east-central Alaska, belt consists chiefly of extensive granitic plutons, chiefly granodiorite, lesser diorite, and granite that intrude rocks of the Yukon-Tanana terrane. **REFERENCES**: Misch, 1966; Foster and others, 1987, 1994; Armstrong, 1988; Rubin and others, 1990; Gehrels and others, 1990; Haugerud, 1991; Wheeler and McFeeley, 1991; Woodsworth and others, 1991; van der Heyden, 1992; Journeay and Friedman, 1993

dl **De Long sedimentary basin (Cenozoic) (Beaufort Sea, Chukchi Sea, and adjacent area, unit Czs)**—Basin inferred from the tectonic model for delineation of the structure of the Chukchi Continental Borderland. On the north, the inferred basin includes an area where the seafloor is more than 2,500 m deep, but bathymetry is a poor guide to its areal extent and tectonic character because much of this inferred basin seem to be infilled, or at least masked, by clastic sediment from the Indigirka and Kolyma Rivers. No seismic-reflection or gravity data exist to infer the areal extent of the basin or the thickness of sedimentary rocks within basin. **REFERENCE:** Grantz and others, 1992

dr **Deryugin sedimentary basin (Cenozoic) (Sea of Okhotsk, unit Czs)**—Consists chiefly of a late Oligocene to Quaternary sedimentary basin that is up to 6,000 m thick as interpreted from seismic-reflection data. Basin interpreted to be filled with marine shale, clastic, and siliceous sedimentary rocks. Western part of the basin is the deepest and is intensely deformed with deformation of sedimentary rocks increasing with depth. A chain of positive heat flow anomalies are present along the elongated axis of the basin. The thickness of the crust below the basin is estimated at 21-23 km with a relatively thin continental crustal (granitic?) layer. **REFERENCES**: Mavrinsky and others, 1979; Zhuravlyov, 1984; Baboshina and others, 1984, 1985

ej **East Japan volcanic-plutonic belt (Neogene to Holocene) (Hokkaido Island, Japan, units Qvf, QTvf)**—Consists chiefly of Neogene to Holocene large andesite and rhyolite and lesser basalt volcanoes, dacite to andesite and lesser basalt lava, tuff, breccia, volcanic avalanche deposits and domes, and minor intermediate-composition plutons. Major modern volcanoes occur at Oshima-oshima, E-san, Komagatake, Kariba, Raiden, Niseko, Toya, Usu, Yotei, Shikotsu, Tarumae, Tokachi, Daisetsu, Akan, Kutcharo, Masyu, and Shiretoko. Coeval with volcanic part of Kuril arc to northeast. Overlies many terranes of Hokkaido, i.e. Oshima, Sorachi-Yezo, Kamuikotan, Hidaka, Tokoro and Nemuro terranes.

ek **East Kamchatka volcanic belt (Pliocene to Holocene) (Eastern Kamchatka Peninsula, units Qvi, QTvi)**—Consists chiefly of a major chain of modern volcanoes of Pliocene and younger age. Main lithologies are basalt, andesite-basalt, rare dacite, and tuff. The belt is the northward continuation of modern Kuril volcanic arc which started to form in the Neogene. **REFERENCES**: Vlasov, 1964; Erlikh, 1973; Volynets and others, 1990

es **East Sikhote-Alin volcanic-plutonic belt (Late Cretaceous and early Tertiary) (Eastern part of Russian Southeast, units Kvi, Kpf)**—Consists chiefly of five major units from oldest to youngest: (1) Early Cenomanian rhyolite and dacite at base; (2) Cenomanian basalt and andesite; (3) thick Turonian to Santonian ignimbrite sequences; (4) Maastrichtian basalt and andesite; and (5) Maastrichtian to Danian rhyolite. Paleogene to Miocene high-titanium calc-alkalic basalt and andesite also are present in the belt. Contains coeval, mainly intermediate-composition granitic plutons. For paleomagnetic determinations, two localities from the Primorye region yield grade C results for volcanic and volcanogenic rocks of Upper Cretaceous age, indicating southerly displacements with respect to the Siberian platform of $14^{o}\pm10^{o}$ and $9^{o}\pm11^{o}$. The East-Sikhote-Alin belt is equivalent to Okhotsk-Chukotka volcanic-plutonic belt (unit oc) on strike to the north in Russian Northeast. Overlain by Miocene to Quaternary high-titanium tholeiitic and alkalic basalt (units sp). **REFERENCE:** Nevolina and Sokarev, 1986; Nazarenko and Bazhanov, 1987

esa **Eastern Sakhalin sedimentary basin (Cenozoic) (Sea of Okhotsk, unit Czs)**—Consists chiefly of a Oligocene to Quaternary sedimentary basin that is up to 8,000 m thick. Seismic-reflection data suggest late Miocene to Quaternary marine clastic and siliceous sedimentary rocks form most of basin. **REFERENCES**: Kosygin and others, 1985; Baboshina and others, 1984, 1985

gb **Georgia Basin sedimentary assemblage (Late Cretaceous (Turonian) to Tertiary (Miocene)) (Southern part of Canadian Cordillera, unit TKs)**—Older part (Nanaimo Group) consists chiefly of marine to nonmarine deep-water, deltaic, and fluvial sandstone, shale, and conglomerate, derived locally from the Wrangellia superterrane, but mainly from eastern Coast and Cascade belts to the east and southeast. Younger part (mainly Chuckanut Group) entirely nonmarine sedimentary rocks that were derived mainly from Coast Belt and North Cascades (Johnson, 1984; England and Calon, 1991; Mustard, 1991). Although a forearc setting is postulated for the Cretaceous strata (England and Calon, 1991), deposition of the strata of the Georgia Basin in a foreland basin underlain by the Wrangellia superterrane and the overlying Gravina-Nutzotin-Gambier belt is favored. Deposition is interpreted as occurring in response to Late Cretaceous to Paleogene contraction/transpression, rapid uplift, and erosion of the eastern Coast Belt and North Cascade orogen (Brandon and others, 1988; Monger, 1991c; Monger and Journeay, 1992). Early Tertiary deposition was probably in a transtensional setting (Johnson, 1984). **REFERENCES**: Johnson, 1984; Brandon and others, 1988; Monger, 1991c; Monger and Journeay, 1992

gg **Gravina-Nutzotin-Gambier volcanic-plutonic-sedimentary belt (Late Jurassic and Early Cretaceous) (Eastern-southern Alaska, southeastern Alaska, and Canadian Cordillera, units KJv, KJs, KJpf, Jpf)**—Forms a major middle Mesozoic sequence of volcanic, sedimentary, and plutonic rocks deposited on and intruded into the Wrangellia superterrane. Interpreted as an elongate island arc. Consists of three major volcanic and sedimentary assemblages and coeval plutonic rocks.

In eastern-southern Alaska, the Nutzotin assemblage consists chiefly of argillite, graywacke, and conglomerate, with lesser andesitic and basaltic volcanic and volcaniclastic rocks of the Chisana Formation, Douglas Island Volcanics, and similar unnamed volcanic units. Sedimentary rocks range from deep-marine turbidite deposits to shallow-marine and nonmarine deposits. In eastern-southern Alaska, coarse clastic and volcaniclastic rocks in the Nutzotin part of assemblage were derived from volcanic sources, as well as locally from the underlying Wrangellia superterrane and from unknown metamorphic source terranes.

In southeastern Alaska and the Canadian Cordillera, the belt consists chiefly of intercalated volcanic rocks and sedimentary rocks (Gravina, Dezadeash, and Gambier units) that range in age from Late Jurassic (Oxfordian) through Early Cretaceous (Albian) (Berg and others, 1972; Monger and Berg, 1987; McClelland and others, 1992). Coarse clastic rocks in the Gravina part of assemblage derived from the stratigraphically underlying Wrangellia superterrane mainly to west, but may also have been derived in part from the Stikinia and Yukon Tanana terranes to the east. The Nutzotin part of the unit in eastern-southern Alaska is correlated with the Gravina part of the unit in southeastern Alaska and the Canadian Cordillera. Apparently both units were deposited in separate coeval basins because of a lack of continuity of the units. The Gravina-Nutzotin assemblage is correlated with the Kahiltna assemblage (unit kh) that occurs in western-southern Alaska. The Gravina-Nutzotin unit is locally intensely faulted and folded, and is intruded by mid- and Late Cretaceous granitic, gabbroic, and ultramafic rocks, that form parts of the Chisana, Chitina, and Glacier Bay-Chichagof arcs, and by younger granitic rocks. In southeastern Alaska, the Gravina part of the unit forms an extensive assemblage that overlies the Wrangellia superterrane, and is locally overthrust by the Yukon-Tanana and Taku terranes to the east.

The belt also contains coeval and slightly older (165-94 Ma) quartz diorite and granodiorite plutons. North of 54° N latitude and extending into eastern-southern Alaska, the plutonic rocks of the coeval Nutzotin-Chichagof and Tonsina-Chichagof plutonic belts of Hudson (1983) and coeval stratified units of the Gravina-Nutzotin-Gambier belt intrude or overlie the Wrangellia and Alexander sequences of the Wrangellia superterrane (McClelland and others, 1992; Nokleberg and others, 1994b). South of latitude 54° N, the central Coast Belt contains abundant plutonic rocks of Early Cretaceous age (Wheeler and McFeely, 1991; Woodsworth and others, 1991; Monger, 1991b; Monger, 1993). The Gambier part of the belt in the Canadian Cordillera contains mostly Early Cretaceous strata that is intruded by coeval and slightly younger plutonic rocks (130-94 Ma). These Early Cretaceous strata stratigraphically overlie Middle to Late Jurassic (165-145 Ma) plutons, as well as the Wrangellia superterrane and the Harrison Lake terrane. Coeval Jurassic and Early Cretaceous granitic plutons occur extensively in the southern part of the Canadian Cordillera, with local marked nonconformity between Jurassic granitic rocks and the overlying Early Cretaceous strata (Friedman and Armstrong, 1990; Monger, 1991b, 1993).

In the U.S.A. Pacific Northwest, the Gambier part of the belt consists of the Wells Creek Volcanics of Misch (1966) and the Nooksack Group of Misch (1966) which range in age from Middle Jurassic to Early Cretaceous. The strata are relatively unmetamorphosed arc-derived dacite volcanic rocks of the Wells Creek Volcanics that dip shallowly. These volcanic rocks grade upward into predominantly fine-grained clastic and fossiliferous, but locally coarse-grained conglomeratic arc deposits of the Nooksack Group (Sondergaard, 1979). **REFERENCES**: Misch, 1966; Berg and others, 1972; Richter, 1976, Sondergaard, 1979; Hudson, 1983; Barker, 1987; Brew and Karl, 1988a, b, c; Ford and Brew, 1988; Friedman and Armstrong, 1990; Gehrels and others, 1990; Wheeler and McFeely, 1991; Woodsworth and others, 1991; Monger, 1991b; McClelland and others, 1992; Haeussler, 1992; Cohen and Lundberg, 1993; Monger, 1993

gz **Graben zone (Cenozoic) (Eastern Siberian Sea and adjacent areas)**—Forms continuation of the Arctic Midocean (Gakkel) Ridge onto the Asian continent. Defines the Tertiary and Holocene boundary between the Eurasian and North American plates. The graben zone is defined by gravity anomalies and a few seismic-reflection and refraction profiles. The main, narrow Bel'kov-Svyatoi graben extends from the western end of Kotelniy Island to Cape Svyatoi-nos and is about 500 km long and ranges from 25 to 30 km wide. The grabens are filled by undeformed presumably Late Cretaceous and Cenozoic deposits that range from 4 to 8 km thick. Crustal thickness in the graben zone ranges from 28 to 29 km. Seismicity is diffuse throughout the area, although it seems to be associated with many of the grabens. **REFERENCES:** Volk and Gaponenko, 1981, 1984; Vinogradov, 1984; Kim, 1986; Fujita and others, 1990; Vinogradov and others 1992

hp **Hope sedimentary basin (Late Cretaceous to Quaternary) (Chukchi Sea, unit CzKsv)**—Occurs on the extreme west of Arctic shelf of Russia in Chukchi Sea. Composed of two subbasins, each filled with weakly deformed Late Cretaceous and Cenozoic sedimentary rocks that are about 3 to 4 km deep. Acoustic basement is composed of Early Cretaceous and older rocks. In eastern Hope basin, Late Cretaceous to Paleogene sedimentary rocks (compressional velocity of 3.1 to 3.3 km/s) have a thickness of 800 to 900 m; Paleogene nonmarine clastic rocks (compressional velocity of 1.9-2.9 km/s), 1.5 km; and Neogene marine and nonmarine clastic rocks (compressional velocity less than 1.9 km/s) have a thickness of about 750 m. In western Hope basin, seismic velocities are higher, and the sedimentary rocks are interpreted as slightly older. Narrow grabens are also inferred in the basement of the basin. **REFERENCES:** Kameneva, 1977; Eittreim and others, 1979; Grantz and others, 1975; Grantz, 1981; Pol'kin, 1984; Volk and others, 1984; Shipilov, 1989; Shiplov and others, 1990; Zonenshain, 1990 ia **Interior Alaska volcanic belt (middle Tertiary) (West-Central Alaska and Saint Lawrence Island, Alaska, unit mTvf)**—Consists chiefly of rhyolite and dacite tuff, breccia, and flows of 37 to 44 Ma. Predominantly felsic composition with minor mildly alkalic basalt and andesite. Local basalt and andesite flows. For paleomagnetic determinations, one set of localities in the 53 Ma basalts near Fairbanks yield grade A results which indicate zero displacement with respect to North America ($-3^{o}\pm14^{o}$). The Interior Alaska volcanic belt is either observed or interpreted to overly the Ruby, Angayucham, Koyukuk, and adjacent terranes. **REFERENCE:** Moll Stalcup, 1990, 1994; Roe and Stone, 1993; Moll-Stalcup and others, 1994

ih **Ishikari-Tenpoku-Hidaka sedimentary-volcanic basin (Cretaceous and Late Paleogene to Holocene) (Hokkaido Island, Japan, unit CzKs)**—Consists of following sedimentary formations at Ishikari coal field: (1) Kumaneshiri Group (Cretaceous). Consists chiefly of andesite and basalt volcaniclastic sedimentary rocks, sandstone and mudstone. Total thickness greater than 3000 m. Unit contains Early Cretaceous radiolarians. Ar-Ar age of andesite and basalt is 101.3±3.6 Ma. (2) Rebun Group (Cretaceous). Chiefly andesite and basalt lava and tuff, and volcaniclastic sedimentary rocks. Thickness greater than 2500 m. Contains Early Cretaceous ammonites, corals, and other fossils. Ar-Ar age of volcanic rocks is 100.6 Ma. (3) Ishikari Group (middle to late Eocene). Chiefly nonmarine sandstone and siltstone, lesser brackish to shallow marine sandstone and mudstone. Includes plant fossils and mollusks. Contains Ishikari and Rumoi coal fields. Total thickness about 2400 m. (4) Uryu Group (middle to late Eocene). Chiefly nonmarine sandstone and mudstone, and lesser brackish sedimentary rocks with coal beds. Divided into Shiraki, Uryu, Tachibetsu, Migioomata, Showa, Icchanai, and Opirafuneppuannai Formations in ascending order. Includes plant fossils and mollusks. Coeval with Ishikari Group. (5) Poronai Group (late Eocene to Oligocene). Chiefly marine sedimentary rocks. Divided into Poronai and Momijiyama Formations in ascending order. Contains foraminiferas, mollusks. K-Ar age of mafic volcanic rocks of Momijiyama Formation is 32.6±1.7. Total thickness about 1600 m. (6) Takinoue Formation (early to middle Miocene). Chiefly basal conglomerate, glauconite sandstone in the lower part and mudstone in the upper part. Includes middle Miocene mollusks. Unconformably underlain by Yezo Group of Sorachi-Yezo terrane. Thickness ranges from 150-450 m. (7) Asahi Formation (Miocene). Chiefly nonmarine sedimentary rocks with coal beds. Includes Daishima-type plant fossils. (8) Kawabata Formation (middle Miocene). Chiefly turbidite deposits composed of sandstone, mudstone, and conglomerate. Thickness greater than 4000 m. (9) Iwamizawa Formation (latest middle to late Miocene). Chiefly diatomaceous mudstone locally with intercalated sandstone and conglomerate. Thickness ranges from 100-500 m. And (10) Minenobu Formation (Pliocene). Chiefly sandstone with local pumiceous tuff layers. Contains mollusks and diatoms. Thickness is 200 m. Overlying Quaternary deposits of region consist mainly of lacustrine, fluvial and terrace deposits. The Ishikari-Tenpoku-Hidaka sedimentary-volcanic basin overlies Oshima, Sorachi-Yezo, Kamuikotan and Hidaka terranes. **REFERENCES**: Kato and others, 1990; Kano and others, 1991

io **Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (Middle Jurassic to Early Cretaceous (Neocomian)) (Southeastern to northwestern Russian Northeast, units Ks, KJs, Js, lJs, KJvs, KJv, KJvi, KJvf, lJvf, lJvi, lJvm, lJpf)**—Occurs in a broad northwest-striking region. Consists chiefly of shallow-marine and nonmarine late Middle Jurassic to Neocomian formations overlying Precambrian, Paleozoic, and early Mesozoic rocks of the Kolyma-Omolon superterrane. Mainly sandstone, siltstone, shale, conglomerate, and volcanic rocks of varying composition. Abundant and various macrofossils. Weak deformation of belt with formation of large doubly-plunging anticlines and synclines. The Indigirka-Oloy assemblage includes coeval plutonic rocks and the following distinct volcanic belts and sedimentary basins:

1. The Uyandina-Yasachnaya volcanic belt is located in the southeastern part of the Indigirka-Oloy assemblage (Chersky Range). It consists of calc-alkalic basalt, andesite, and rhyolite interlayered with shallow-marine and nonmarine sandstone, siltstone, shale, and conglomerate, and is interpreted as an arc that formed along the margin of the Kolyma-Omolon superterrane. The belt contains Oxfordian, Kimmeridgian and Early Volgian macrofossils. The basal part includes thick Bathonian and Bathonian to Callovian conglomerate and sandstone. The belt also includes a Bathonian to Callovian olistostrome that contains Paleozoic limestone, greenschist, and ophiolite fragments. The Uyandina-Yasachnaya volcanic belt overlies the Prykolyma, Omulevka, and Rassokha terranes of the Kolyma-Omolon superterrane. To the west, volcanic rocks of the

ophiolite fragments. The Uyandina-Yasachnaya volcanic belt overlies the Prykolyma, Omulevka, and Rassokha terranes of the Kolyma-Omolon superterrane. To the west, volcanic rocks of the Uyandina-Yasachnaya volcanic belt grade into thick Middle-Late Jurassic turbidite deposits with rare macrofossils that are located in the Polousny and In'yaly-Debin synclines. The turbidite deposits overlie the Kular-Nera terrane and occur in tight northwest- and southwest-verging folds which are cut by granitic rocks with Ar-Ar and K-Ar ages of 120 to 144 Ma. Back-arc deposits are present to the northeast in the Ilin-Tas anticline.

2. The Zyryanka sedimentary basin is located in a 60-km-wide and 550-km-long basin that extends toward the northwest in the southwestern and central part of the Indigirka-Oloy assemblage. The basin contains Upper Jurassic marine black shale, siltstone, and sandstone (1,000 to 2,000 m thick), Lower Cretaceous lagoonal, deltaic, and lacustrine-alluvial sandstone, siltstone, shale, and coal (4,000 m thick), Upper Cretaceous sandstone, siltstone, clay, conglomerate, and brown coal (500 m thick), and Paleogene and Neogene nonmarine fluvial sedimentary rocks with thin brown coal beds (1,500 m thick). The Zyryanka basin formed in the back-arc region of the Uyandina-Yasachnaya arc.

3. The Late Jurassic-Neocomian Oloy-Svyatoy Nos volcanic belt occurs along the northeastern margin of the Kolyma-Omolon superterrane and adjacent to the South Anyui terrane. The belt consists of mainly shallow-marine, rarely nonmarine basalt, andesite, rhyolite, and tuff with interlayered sandstone, conglomerate, siltstone, and shale. The belt also contains small bodies of granite, granodiorite, and monzogranite.

4. Along the southeastern margin of the Kolyma-Omolon superterrane are the small Ainakhkurgen, Umkuveem, and Upper Penzhina basins which are filled with Volgian and early Neocomian graywacke and shale up to 3000 m thick. Eastward, these basins are overlapped by Albian to Late Cretaceous volcanic rocks of the Okhotsk-Chukotka belt.

5. The North Omolon basin occurs along the boundaries of the Omolon, Oloy, and Berezovka terranes, and consists of shallow marine and nonmarine Late Jurassic and Neocomian sandstone, shale, conglomerate, and alkalic basalt that range up to 3,000 m thick. **REFERENCES**: Paraketsov and Paraketsova, 1973; Filatova, 1979; Koporulin, 1979; Sosunov and others, 1982; Parfenov, 1984; Stavsky, 1984; Terekhov and others, 1984; Natapov and Surmilova, 1986; Archegov and others, 1987; Gaiduk, 1988; Gaiduk and others, 1989, 1993; Danilov and Dylevsky, 1990; Shul'gina and others, 1990

ka **Kamloops magmatic belt (early Tertiary) (Central and southern Canadian Cordillera, units Tv, Tpf)**—Consists chiefly of 55-46 Ma, calc-alkalic to alkalic felsic, intermediate and mafic volcanic and sedimentary strata, and comagmatic granodiorite, syenite, and quartz monzonite plutonic rocks. The volcanic rocks may be surface equivalents of early Tertiary plutonic rocks in the eastern Coast Belt (youngest part of Coast-North Cascade belt). In parts of south-central British Columbia and northeastern Washington, the belt is typically alkalic, and emplacement was concurrent with widespread basin-and-range style extension. For paleomagnetic determinations, grade A data from 49 Ma volcanic rocks indicate no displacement with respect to North America within error limits ($7^{o} \pm 10^{o}$). **REFERENCES:** Ewing, 1980; Parrish and others, 1988; Symons and Wellings, 1989

kb **Kuibiveem sedimentary assemblage (Cretaceous) (Eastern Russian Northeast, unit Ks)**—Consists chiefly of folded marine sedimentary rocks (including turbidite deposits) with Albian to Late Cretaceous macrofossils. Early part of Albian and Turonian units (Kuibiveemskaya and Perekatninskaya Formations) composed of sandstone, siltstone, and conglomerate. Locally faulted and tectonically imbricated. Santonian and Campanian sequence unconformably overlies Albian and Turonian sequence and consists of sandstone, siltstone, argillite, conglomerate, and rare chert and andesite tuff. Thickness greater than 2,000 m. **REFERENCES**: Aleksandrov, 1978; Zinkevich, 1981; Sokolov, 1990, 1992

kc **Central Kamchatka volcanic belt (Eocene to Quaternary) (Central Kamchatka Peninsula, unit QTvi)**—Extends for 1,500 km longitudinally the Kamchatka Peninsula (Sredinnyi Range). Chiefly thick, gently dipping andesite, dacite, and rhyolite strata interlayered with sandstone, siltstone, and conglomerate, and widespread large ignimbrite fields. Shallow-marine deposits predominant in the lower part and nonmarine deposits predominant in the upper part. Formation of the belt culminated with eruptions of Pliocene to Quaternary plateau basalts that are associated with stratovolcanoes. **REFERENCES**: Vlasov, 1964, 1977; Erlikh, 1973; Poplitove and Volynets, 1982

kh **Kahiltna sedimentary and volcanic assemblage (Late Jurassic and Cretaceous)**

(**Southern and southwestern Alaska, unit KJs**)—Consists chiefly of structurally disrupted, deep marine, partly volcaniclastic, graywacke, argillite, and flysch with minor amounts of chert, limestone, conglomerate, and andesite. Mainly Early Cretaceous, but includes rocks ranging in age from Late Jurassic to early Late Cretaceous. Metamorphism is mainly lower greenschist facies, but ranges from zeolite to amphibolite facies. Occurs mainly along northwest margin of Peninsular sequence of Wrangellia superterrane. Interpreted to have originally stratigraphically overlain Peninsular sequence on Alaska Peninsula. Thrust over Wrangellia sequence in central Alaska Range. May be equivalent to Maclaren Glacier metamorphic belt of the Maclaren terrane in eastern Alaska Range. In southwestern Alaska, the Kahiltna assemblage is interpreted to be stratigraphically overlain by Cretaceous marine sedimentary rocks of the Kuskokwim Group (unit kw) to north, although the Kahiltna assemblage locally contains Late Cretaceous *Inoceramus* (Turonian). In poorly mapped areas, the Kahiltna assemblage seems to grade upward into the Cretaceous Kuskokwim Group. For paleomagnetic determinations, grade A data from a series of 66 Ma extrusive volcanic rocks indicate southerly displacements of $14^{\circ}\pm6^{\circ}$ with respect to North America. The Kahiltna assemblage is correlated with the Gravina-Nutzotin-Gambier volcanic-sedimentary-plutonic belt to east and southeast. Intensely faulted and folded. Contains fault slices of several small terranes, including the Broad Pass, Chulitna, Susitna terranes. Also includes West Fork terrane, a sequence of Jurassic chert, argillite, sandstone, volcaniclastic sandstone, and conglomerate, that is too small to depict on map. Former Kahiltna terrane of Jones and others (1981, 1987). **REFERENCES**: Reed and Nelson, 1980; Csejtey and others, 1986; Jones and others, 1981, 1987; Thrupp and Coe, 1986; Bundtzen and others, 1988; Wallace and others, 1989

kk **Kamchatka-Koryak volcanic belt (Lesser Late Cretaceous and mainly Paleocene, Eocene, and Miocene) (Kamchatka Peninsula and eastern Russian Northeast, units eTvi, eTvm, eTs, mTvi, mTvf)**—Extends for 800 km parallel to but mainly east of the northern part of the Okhotsk-Chukotka volcanic-plutonic belt. Occurs in discontinuous and isolated volcanic fields and consists of gently dipping nonmarine volcanic rocks of various compositions, and sandstone, gritstone, and conglomerate with flora. Lower part consists of mafic volcanic rocks, mainly Maastrichtian-Danian tholeiitic basalt, along with abundant Paleocene to Eocene alkali basalt, and associated and minor diorite, monzonite, gabbro, granodiorite, and granite that yield K-Ar ages of 56-73 Ma. Upper part consists of calc-alkalic dacite, rhyolite, andesite, and basalt with late Eocene-early Miocene flora and K-Ar ages, and associated with subvolcanic bodies and dikes of rhyolite, granodiorite, and diorite. **REFERENCES**: Filatova, 1988; Zinkevich, 1981

km **Kuskokwim Mountains sedimentary, volcanic, and plutonic belt (Late Cretaceous and early Tertiary) (Southwestern Alaska, units TKv, TKp)**—Consists chiefly of volcanic rocks and minor interlayered tuffaceous sedimentary rocks. Also includes minor sedimentary rocks, mainly conglomerate to coarse-grained sandstone turbidite deposits deposited in deep-marine conditions, and lesser sandstone and conglomerate deposited in shallow-marine to nonmarine conditions along the flanks of the unit. Volcanic rocks consist chiefly of rhyolite and dacite domes, flows, and tuff, and dacite, andesite, and basalt flows of 58 to 77 Ma that display moderate-K calc-alkalic to shoshonitic compositional trends. Belt contains numerous related volcano-plutonic complexes, dikes, and plutons that exhibit a wide compositional range, including gabbro, quartz diorite, granodiorite, monzonite, and syenite. Belt is coeval with part of Alaska Range-Talkeetna Mountains belt to south, and partly coeval with Yukon-Kanuti belt to north. The belt is locally intensely folded and faulted, and extends for over 800 km in southwestern to east-central Alaska. For paleomagnetic determinations, volcanic and volcanogenic sedimentary rocks of Late Cretaceous age (79 Ma) from St. Matthew Island yield displacements between 0 and 12° depending on the way in which ancient horizontal is estimated. The preferred interpretation shows a southerly displacement of $12^{\circ}\pm5^{\circ}$ with respect to North America. The belt overlies the Kahiltna sedimentary and volcanic assemblage to the south, and overlies the Ruby, Angayucham, Nixon Fork, Minchumina, Dillinger, Koyukuk, Nyac, Kilbuck, Togiak, and Goodnews terranes to the north.

In northern part of southwestern Alaska and northern part of west-central Alaska, the Kuskokwim Mountains belt includes Yukon-Kanuti volcanic-plutonic belt of early Tertiary age. Yukon-Kanuti belt chiefly dacite, andesite, rhyodacite, and rhyolite flows, domes, and tuffs of 47 to 66 Ma. Sparse, local basalt flows. Yukon-Kanuti belt exhibits moderate- to high-K calc-alkalic compositional trend. Moderate number of related granodiorite dikes and plutons. Yukon-Kanuti belt extends for over 300 km in west-central Alaska, and overlies the Koyukuk, Ruby, and Angayucham terranes. **REFERENCES:** Bundtzen and Gilbert, 1983; Wittbrodt and others, 1989; Moll-Stalcup, 1990, 1994; Miller and Bundtzen, 1993; Moll-Stalcup and others, 1994

kn **Kandik River sedimentary overlap assemblage (Cretaceous, Jurassic, and Late Triassic) (East-central Alaska, unit KJs)**—Consists chiefly of Late Triassic, Jurassic, and Early Cretaceous shelfal shale and quartzite (Glenn Shale, Keenan Quartzite) overlain by mainly graywacke turbidites and nonmarine molasse strata that were recycled from foreland basin deposits (Biederman Argillite, and Kathul Graywacke). Generally broadly folded with local, small isoclinal folds. Locally isoclinally folded and with low-grade regional metamorphism. Kandik River assemblage thrust onto miogeoclinal margin of western North America along northwest-dipping thrusts. Kandik River assemblage interpreted as a faulted overlap assemblage originally deposited on Porcupine terrane to northwest, and possibly also on North American craton margin to east. Structurally overlain by Angayucham and Porcupine terranes along northwest-dipping thrusts. **REFERENCES:** Brabb and Churkin, 1969; Churkin and others, 1982; Howell and Wiley, 1987; Dover, 1990; Howell and others, 1992

ko **Khingan-Okhotsk volcanic-plutonic belt (Cretaceous) (Northern part of Russian Southeast, units Kvi, Kpf)**—Consists of a chain of volcanic fields of similar age, lithology, and stratigraphy. Divided into two main sequences: (1) Barremian to Cenomanian andesite and minor basalt, with coeval gabbro, diorite, and granodiorite. Andesite exhibits calc-alkalic composition, whereas basalt exhibits tholeiitic composition. And (2) Late Cretaceous (mainly pre-Senonian) suite of K-rich felsic volcanic rocks, tuff, ignimbrite, and coeval subvolcanic intrusive and granitic rocks. Belt overlies Turan and Malokhingask terranes of Bureya superterrane, and Badzhal and Ulban terranes. The belt is interpreted as a magmatic arc tectonically paired to the Early Cretaceous accretionary-wedge and subduction-zone complexes of the Khabarovsk, Amur River, and Kiselevka-Manoma terranes. **REFERENCES**: Sukhov, 1975; Scheglov, 1984; Natal'in, 1991, 1993

ku **Kuril volcanic arc (early Miocene to Holocene) (Kamchatka Peninsula, unit QTvi)**—Consists chiefly of four assemblages: (1) green tuff (early to middle Miocene); (2) volcanic-cherty-diatomaceous rocks (late Miocene to early Pliocene); (3) basalt (late Pliocene); and (4) andesite and associated rocks that form Quaternary active volcanoes. Associated local hypabyssal and plutonic rocks, gabbro, diorite, and diabase. **REFERENCE**: Piskunov, 1987

kw **Kuskokwim Group (Cretaceous) (Southwestern Alaska, unit Ks)**—Consists chiefly of Cretaceous (Albian to Coniacian) marine turbidite deposits, and subordinate shallow-marine and fluvial strata, mainly quartzose lithic conglomerate, and sandstone and siltstone turbidite deposits. The Kuskokwim Group was deposited in a faulted, elongate southwest-trending sedimentary basin. The group is thickest (greater than 10,000 km thick) and displays the deepest water facies in the central part of the basin. The mixed marine and nonmarine sections are relatively thin (less than 3,000 km thick) and are mainly restricted to the margins of the basin. Sandstone and conglomerate clast compositions from through the basin suggest derivation from local sources. The Kuskokwim Group is generally deformed into broad open folds, but near the southeast margin, is deformed into overturned or isoclinal folds and thrust faults. For paleomagnetic determinations, mid-Cretaceous sedimentary rocks of the Yukon-Koyukuk basin have been extensively sampled and yield four grade A data sets. These indicate southward displacements between 10° and 17° with respect to North America. Five volcanic rock sequences sampled range in age from 65 to 43 Ma, and yield grade A to D data. All of these data indicate no displacement within their error limits. The Kuskokwim Group overlaps the Angayucham, Dillinger, Goodnews, Kilbuck-Idono, Nixon Fork, Ruby, Togiak, and Tikchik terranes, and the Late Jurassic and Cretaceous Kahiltna sedimentary and volcanic assemblage (unit kh). In poorly mapped areas, the Kahiltna assemblage seems to grade upward into the Cretaceous Kuskokwim Group. **REFERENCES**: Harris, 1985; Harris and others, 1986; Wallace and others, 1989; Box and Elder, 1992; Decker and others, 1994; Kirschner, 1994

lb **Lebed sedimentary basin (Cenozoic) (Eastern Sea of Okhotsk, unit Czs)**—Consists chiefly of Eocene to Quaternary marine clastic rocks up to 4,000 m thick. Weakly deformed. **REFERENCES**: Gnibidenko and Khvedchuk, 1984; Baboshina and others, 1984, 1985; Kosygin, 1985

mak **Makarov sedimentary basin (Cenozoic) (Sea of Okhotsk (near Sakhalin Island), unit Czs)**—Consists chiefly of Miocene to Quaternary sedimentary rocks with thickness of up to

4 km. Seismic data indicate sedimentary rocks occur in two units, an upper subhorizontal unit, and a lower, more deformed unit that fills irregularities in the surface of acoustic basement. The basin overlaps the suture separating the Academy of Sciences and Institute of Oceanology collages. **REFERENCES**: Baboshina and others, 1984; Gnibidenko and Khvedchuk, 1984; Kudelkin and others, 1986

nb **Northwind sedimentary basin (Cenozoic) (Beaufort Sea, Chukchi Sea, and adjacent area, unit Czs)**—Consists chiefly of Cenozoic sedimentary rocks that are greater than 2,000 m thick, as indicated by bathymetry and gravity modeling. Underlain by oceanic or attenuated continental crust. A seismic-reflection profile from the east flank of the basin near 75° N latitude indicates that the sedimentary section in the basin is more than 1.7 km thick. **REFERENCES**: Grantz and others, 1975, 1990

nc **North Chukchi (Vil'kitskii) sedimentary basin (Tertiary and Quaternary) (Northern part of Chukchi Sea, unit Czs)**—Consists chiefly of Cenozoic progradational sequence of clastic sedimentary rocks that reaches thicknesses of 4 to 8 km. Configuration of basin defined by seismic-reflection data in the east and potential field data in the west; westward extent of basin is uncertain. Contains shale diapirs **REFERENCES:** Kos'ko, 1984, 1988; Fujita and Cook, 1990; Grantz and others, 1975, 1990

no **North Okhotsk sedimentary basin (Cenozoic) (Sea of Okhotsk, unit Czs)**—Consists chiefly of Cenozoic sedimentary rocks up to 9,000 m thick that fill a series of troughs separated by transverse and longitudinal uplifts. Basin defined mainly by seismic data and one well. Volcanogenic and sedimentary rocks at base of basin may be Late Cretaceous. Sedimentary rocks chiefly represented by shale and lesser sandstone and siliceous sedimentary rocks. Lower horizons of the sedimentary cover are deformed by faults. Basin interpreted to have formed from collision of Okhotomorsk collage with subduction-zone margin of Asian continent in the Late Cretaceous and Paleogene. **REFERENCES**: Baboshina and others, 1984, 1985; Kulikov and others, 1988

ns **Nelson plutonic suite (Jurassic) (Southeastern Canadian Cordillera, unit Jpf)**—Consists chiefly of granodiorite, quartz monzonite, and local monzonite plutons that yield isotopic ages mainly of 185-155 Ma local crustal inheritance. Intrudes Quesnellia and Kootenay terranes and (locally) North American craton margin. Emplacement was at least partly coeval with major regional compression. **REFERENCES**: Archibald and others, 1983; Armstrong, 1988; Parrish and others, 1988; Woodsworth and others, 1991

nsb **New Siberian (Novosibirsky) sedimentary basin (Late Cretaceous? to Quaternary) (East Siberian Sea, unit CzKsv)**—Consists chiefly of Late Cretaceous to Quaternary deltaic and shelf sedimentary rocks. Unit unconformably overlies presumed Paleozoic and Mesozoic basement which contains seismic reflectors to 10 km depth. Seismic-reflection data indicate basin depth of about 3 km. A graben occurs along southern edge of the basin and is filled with 4.5 to 5.0 km of synrift sedimentary rocks. The southern Novosibirsky basin is separated from the Blagoveshchensk basin by a fault zone. **REFERENCES:** Kogan, 1981; Volk and Gaponenko, 1981; Kos'ko, 1984, 1988; Volk and others, 1984; Fujita and Cook, 1990

oc **Okhotsk-Chukotka volcanic-plutonic belt (Early Cretaceous and Late Cretaceous, locally Paleocene) (Eastern Russian Northeast, units Kvi, Kpf)**—Extends for 3000 km along western margin of Sea of Okhotsk. Consists of gently dipping basalt, andesite-basalt, andesite, dacite, rhyolite, tuff, rare beds of nonmarine clastic rocks, with conglomerate, grit, and sandstone at the base. Local widespread silicic volcanic rock (mainly ignimbrites) and associated tonalites, quartz-diorite, and rare granite. To the west toward the continent, Late Cretaceous plutonic rocks grade into subalkalic and alkalic granite. The Okhotsk-Chukotka belt is equivalent to the East Sikhote-Alin volcanic-plutonic belt (unit es) in the Russian Southeast, and overlies the southeastern margin of the North Asian craton and the Kolyma-Omolon superterrane, as well as the Chukotka, Kony-Murgal, Okhotsk, Seward, South-Anyui, and Zolotogorskiy terranes of the Russian Northeast. The Okhotsk-Chukotka belt is interpreted as a continental-margin arc marking the Albian through Campanian and locally Paleocene boundary of northern Asia The Paleocene part locally consists mainly of plateau theoleiitic basalt. The plutonic part of Okhotsk-Chukotka belt is interpreted as extending eastward across the Bering Straits into the Seward Peninsula in western Alaska. **REFERENCES**: Belyi, 1977, 1978; Filatova, 1988; Lebedev and others,, 1989; Bakharev, 1976; Zagruzina, 1977; Parfenov, 1984 om **Omineca-Selwyn plutonic belt (mid-Cretaceous) (Eastern Canadian Cordillera, interior and northern Alaska, and northern Russian Northeast, units eKpf, Kpf)**—Consists chiefly of granodiorite, granite, quartz syenite and minor syenite plutons of Early to mid-Cretaceous age (110-90 Ma) that form an extensive belt of discrete intrusions. This belt includes the easternmost magmatic rocks in the Canadian Cordillera, and the northernmost plutonic rocks in interior and northern Alaska and in the northern Russian Northeast. Many plutons exhibit S-type character. Extrusive equivalents (such as the South Fork volcanic rocks in the Yukon Territory) are rare. Commonly, the plutons have high initial strontium ratios (about 0.710) indicating partial derivation from old cratonic crust (Armstrong, 1988: Woodsworth and others, 1991). The spatial location of the belt about 200 km west of the eastern limit of Cordilleran deformation and chemistry suggests an anatectic origin of partial melting of cratonic crust during thickening caused by Cretaceous contraction. Armstrong (1988), however, interprets the belt as the rear part of a single broad mid-Cretaceous, Cordillera-wide, subduction-related arc.

In interior and northern Alaska, the Omineca-Selwyn belt consists of large plutons of mid-Cretaceous granite and lesser syenite and granodiorite that occur in an elongate trend that extends from east-central to west-central Alaska, the Seward Peninsula, and St. Lawrence Island. The belt includes the Ruby geanticline plutons of central Alaska. Granitic plutons tend to be K-rich, locally ultrapotassic Na-depleted, and weakly to moderately peraluminous, are locally part of the ilmenite series, and exhibit S-type characteristics (Miller, 1989, 1994). Plutons are interpreted as the product of melting or contamination of continental crust.

In the northern Russian Northeast, belt consists of a suite of Early Cretaceous granitic rocks that are overlain by volcanic rocks of Okhotsk-Chukotka volcanic-plutonic belt. Omineca-Selwyn belt interpreted as a suite of anatectic granitic rocks that formed in the late stages of, and immediately after major terrane collision and compression along a broad segment of the North America Cordillera and extending into the northern Russian Northeast. **REFERENCES**: Sosunov and others, 1982; Sosunov, 1984; Foster and others, 1987, 1994; Armstrong, 1988; Miller, 1989, 1994; Woodsworth and others, 1991

oo **Oregon-Olympic sedimentary forearc basin (Eocene to Miocene) (U.S.A. Pacific Northwest, and offshore of Vancouver Island, Canadian Cordillera, unit Czs)**—Consists chiefly of three lithofacies: (1) lithic sandstone, shale, and conglomerate of marine fan origin; (2) arkosic sandstone, shale, and conglomerate of fluvial and deltaic origin; and (3) volcanic sandstone and shale (Heller and others, 1987). The lithic sandstone is present in the Aldwell, Lyre, Hoko, and Makaw Formations on the northern Olympic Peninsula (Rau, 1963; Snavely and others, 1980, 1993) and in southern Oregon as the Roseburg, Lookingglass and Flournoy Formations (Ryberg, 1984; Molenaar, 1985). The arkosic facies is present in the Chuckanut and Swauk Formations (Tabor and others, 1984; Johnson, 1984; Taylor and others, 1988), and the Tyee and Yamhill Formations in Oregon (Snavely and others 1964; Heller and others 1985). The volcanic petrofacies is present in the Blakely and Lincoln Creek Formations (Rau, 1967) and the Nestacca and Coaledo in Oregon (Snavely and others, 1969; Baldwin 1974). **REFERENCES:** Rau, 1963, 1967; Snavely and others, 1964; 1969; 1980, 1993; Baldwin 1974; Johnson, 1984; Ryberg, 1984; Tabor and others, 1984; Heller and others, 1985; 1987; Taylor and others, 1988; Molenaar, 1985

os **Oshima sedimentary-volcanic basin (late Paleogene to Quaternary) (Hokkaido Island, Japan, unit Czvi)**—Consists of following sedimentary units: (1) Futoro, Matahachizawa, Aonaegawa and lower Kayamuma Formations (late Oligocene to early Miocene). These units consist chiefly basalt lava, rhyolite-andesite lava and tuff, sandstone and mudstone. K-Ar age of andesite lava is 24 Ma, and fission track ages of rhyolite range from 21.8 to 31.9±1.3 Ma. (2) Kunnnui Formation (early to middle Miocene) which consists chiefly of sandstone, mudstone, tuff and andesite lava. Fission track age of tuff is 14.5 and 17.1 Ma. Contains diatoms. (3) Hiyama Group (middle Miocene to Pliocene), which consists chiefly of marine sandstone, siltstone, mudstone, tuff, and andesite lava and pyroclastic rocks. Includes mollusks, foraminifera and diatoms. Fission track age of tuff ranges from 11.2 to 4.0. And (4) Setana Formation (Pliocene) which consists chiefly of sandstone and conglomerate. Includes mollusks and foraminifers. Quaternary of this basin consists mainly of lacustrine, fluvial, and terrace deposits. Basin overlies Oshima terrane. **REFERENCES**: Kato and others, 1990; Kano and others, 1991 pn **Penzhina sedimentary basin (Albian and Late Cretaceous) (Central part of Russian Northeast, unit Ks)**—Consists chiefly of Albian to Late Cretaceous sedimentary rocks that comprise a northeast-striking trough about 90 km wide and 500 km long. Basin contains up to 6,000 m of littoral-marine and nonmarine clastic rocks and coal. Clastic rocks consist chiefly of volcanic and polymictic sandstone, conglomerate, siltstone, argillite, and local tuff, with mollusks and plant fossils. Weakly deformed into locally large anticlines and synclines. The Penzhina basin occurs to east of Okhotsk-Chukotka volcanic-plutonic belt and is interpreted as a forearc basin for the belt. **REFERENCES**: Ivanov and Pokhialainen, 1973; Parfenov, 1984; Kovaleva, 1985

rc **Raucha sedimentary basin (Jurassic (Volgian) to Early Cretaceous) (Northeastern part of Russian Northeast, unit KJs)**—Chiefly shallow-marine sedimentary rocks, mainly sandstone, siltstone, and mudstone with minor rhyolite, dacite, and andesite tuffs and flows. Contains *Buchia* and ammonites. Sedimentary and volcanic rocks of unit unconformably overlie Triassic and Early Jurassic deposits of Anyui and Chauna subterranes of Chukotka terrane. **REFERENCES**: Gorodinskiy and Paraketsov, 1960; Paraketsov and Paraketsova, 1989

sb **Spences Bridge volcanic-plutonic belt (mid-Cretaceous) (Southern British Columbia, Canadian Cordillera, units Kv)**—Lower part consists chiefly of intermediate, locally felsic, calc-alkalic, continental-margin arc volcanic and lesser plutonic rocks of mid-Cretaceous age (105 Ma). Upper part consist of mafic andesites that are possibly rift related. For paleomagnetic determinations, data from 100 Ma sedimentary and volcanic rocks yield grade A southerly displacements of $13^{o} \pm 5^{o}$ with respect to North America. The volcanic rocks of the belt overlie both Cache Creek and Quesnellia terranes and are associated with hypabyssal and deeper granitic plutons along strike. The Spences Bridge volcanic-plutonic belt is correlated with the Gravina-Nutzotin-Gambier volcanic-plutonic-sedimentary belt (Monger and others, 1994), and may also be the youngest part of the Middle Jurassic and younger Tahtsa-Twin Sisters-Francois Lake magmatic assemblage. **REFERENCE:** Thorkelson and Smith, 1993; Monger and others, 1994

sf **Sanak-Baranov plutonic belt (Late Cretaceous and early Tertiary) (Coastal southern Alaska, units TKpf, mTpf)**—Forms a broad belt across coastal Southern Alaska. Consists chiefly of granite and lesser granodiorite that intruded immediately after a period of intense deformation and regional metamorphism associated with accretion of younger part of Chugach terrane and Prince William terrane. Unit yields K-Ar ages that range from 45 to 60 Ma. Locally associated with Chugach metamorphic complex in eastern-southern Alaska. Interpreted as forming during underthrusting of Kula oceanic ridge along the early Tertiary Alaskan continental margin. **REFERENCES:** Hudson, 1983; Plafker and others, 1989b; Moll-Stalcup, 1994; Moll-Stalcup and others, 1990, 1994; Farmer and others, 1993

sh **Shirshov Ridge volcanic belt (early Tertiary?) (Western Bering Sea, unit Czv)**—Consists chiefly of two units: (1) a relatively older oceanic assemblage of amphibolite, gabbro, diabase, basalt, and chert. Chert contains Late Cretaceous (Campanian to Maastrichtian) to early Paleogene microfauna; and (2) a relatively younger volcanic arc assemblage of altered andesite, volcaniclastic sedimentary rocks, and shale of Miocene and younger age. Lithologic data for both units from sparse dredge samples. The western slope and the summit of the Shirshov Ridge comprise a series of normal scarps that face the Komandorsky Basin. The scarps divide the ridge into several north-striking blocks that descend step-by-step toward the basin floor. The ridge is interpreted either as: (1) the rifted remnant of an early Tertiary volcanic arc that formed approximately in place (Scholl and others, 1992); (2) a thrust-thickened stack of oceanic crust that formed in the Neogene (Bogdanov and Neprochnov, 1984); or (3) a mass of igneous rock constituting an oceanic plateau that was accreted to the margin of the northeastern Kamchatka Peninsula (Koryak Highland) (Ben-Avraham and Cooper, 1981). **REFERENCES:** Ben-Avraham and Cooper, 1981; Baranov and others, 1984; Bogdanov and Neprochnov, 1984; Baranov and others, 1991; Scholl and others, 1992

sk **Skeena sedimentary assemblage (Early Cretaceous) (Northern British Columbia, Canadian Cordillera, unit Ks)**—Consists chiefly of Early Cretaceous fluvial-deltaic to shallow-subtidal sandstone, chert-clast-rich conglomerate, sandstone, siltstone, and carbonaceous shale with minor interbedded volcanic rock. Clastic rocks derived in large part from rocks to the northeast, but contain local interbedded basaltic to rhyolitic volcanic rocks. Local western sources for clastic rocks. **REFERENCE:** Bassett, 1991

sn **Skonun sedimentary assemblage (Miocene and Pliocene) (East of Queen Charlotte Island, western part of Canadian Cordillera, unit Ts)**—Consists chiefly of Miocene and Pliocene marine and nonmarine sandstone, mudstone, conglomerate, and coal. Presently mainly submerged. Interpreted as being deposited during rift-related(?) subsidence of the Queen Charlotte basin. **REFERENCE:** Higgs, 1991

so **South Okhotsk sedimentary basin (Cenozoic) (Southern Sea of Okhotsk, unit Czs)**—Consists chiefly of clastic sedimentary rocks ranging up to 4 km thick. Seismic investigations reveal two units: (1) a lower, 3-km-thick sequence of acoustically transparent rocks composed of shale and argillite; and (2) an upper, 1-km-thick sequence of coherently bedded turbidite deposits with tuffaceous layers of presumed late Miocene to Pliocene age. **REFERENCES**: Gnibidenko and Svarichevsky, 1984; Sergeev and Krasny, 1987

sp **Sakhalin-Primorye volcanic belt (late Tertiary and Quaternary) (Sea of Japan and adjacent continental areas, unit QTvm)**—Consists chiefly of late Cenozoic basalt that occurs in relatively small eruptive fields that are closely associated with grabens and bounding faults. Basalts range in composition from quartz tholeiite to olivine nephelenite and basanite. The basanite locally contain xenoliths of spinel and garnet peridotite, pyroxenite, and harzburgite. The proportion of alkalic and tholeiitic lava and geochemical characteristics differ with location. Alkali basalt is predominant in the continental area of eastern China, whereas tholeiite, with an unusually low K_2O content (less than 0.25%), are present in the East Sikhote-Alin region adjacent to the riftogenic basin of the Sea of Japan. Basalt in the East Sikhote-Alin region and Hokkaido is more enriched in the mobile incompatible elements, such as Rb, Ba, Sr, and is depleted in Nb and Ta relative to Chinese and Korean basalt and most basalts plot within a mantle array, with initial Sr ratios ranging from 0.7037 to 0.7057. Geochemical and isotopic data indicate at least two-component magma mixing between magmas resulting from depleted and enriched mantle sources. The latter is proposed to be metasomatized subcontinental lithosphere mantle.

On Sakhalin Island, the volcanic belt consists of three complexes: (1) Miocene subalkalic andesite-basalt, basalt, rarely rhyolite, and subvolcanic intrusions of diorite; and rare rhyolite, (2) Late Miocene to early Pliocene trachybasalt, trachydiabase, subvolcanic intrusions of monzonite, essexite, and other alkalic rocks; and (3) Pliocene olivine basalt and diabase, and rare andesite and dacite. Local subvolcanic intrusions of gabbro. Both marine and nonmarine eruptive settings. Numerous macrofossils and flora fossils.

The western part of the Sakhalin-Primorye belt in the western Russian Southeast is interpreted as forming during asymmetric extension; the eastern part of belt is interpreted as forming during rifting of the Sea of Japan that may be related to the Late Cenozoic Kuril and East Japan igneous arcs. **REFERENCES**: Geology of the U.S.S.R., Sakhalin Island, 1970, Semenov, 1975; Martynov, 1994; Martynov and Levashov, 1988; Nakamura and others, 1990; Martynov and Okamura, 1993

tn **Tinro sedimentary basin (Late Cretaceous and Cenozoic) (Sea of Okhotsk, unit Czs)**—Consists chiefly of Late Cretaceous and Cenozoic marine clastic and siliceous sedimentary rocks up to 10,000 m thick. Seismic-reflection data indicate four unconformable sequences in the deepest part of the basin. The basement of the basin may be entrapped oceanic crust that was not subducted during the collision of the Okhotomorsk collage. **REFERENCES**: Zhuravlyov; 1984; Baboshina, 1984, 1985

to **Torom sedimentary basin (Late Jurassic and Early Cretaceous) (Northeastern part of Russian Southeast, unit KJs)**—Consists chiefly of sandstone, siltstone, and minor conglomerate. Late Triassic through Hauterivian deposits contain marine fauna; younger sandstone contains Albian(?) flora. Sedimentary rocks of basin rest unconformably on Galam and Tugur subterranes of Galam terrane. **REFERENCE**: Kozlovsky and others, 1988

tt **Tahtsa-Twin Sisters-Francois Lake magmatic assemblage (Middle Jurassic to Early Cretaceous) (Central part of Canadian Cordillera, unit Jpf)**—Occurs between latitudes 54 to 51° N in north-central British Columbia on the east side of the Coast Belt and consists chiefly of Jurassic and Cretaceous plutonic rocks. Also occurs between latitudes 50 to 52°N on east side of the Coast Belt where unit consists chiefly of minor volcanic and sedimentary rocks. The plutonic rocks of the unit are chiefly Middle to Late Jurassic granitic rocks that apparently post-date the accretion of the Stikinia terrane to the North American plate in the Late Jurassic (about 170 Ma). Magmatic assemblage widely distributed between the western Coast and eastern Omineca belts. Named by van der Heyden (1992) as part of the *ancestral Coast Belt arc* which is interpreted as the middle Mesozoic continental-margin arc of western North American. The oldest part of the assemblage may be equivalent to the Nelson plutonic suite and the youngest part of the assemblage may be equivalent to the Spences Bridge volcanic-plutonic belt. The assemblage may correlate in part with the Gravina-Nutzotin-Gambier volcanic-plutonic-sedimentary belt. **REFERENCES:** Woodsworth and others, 1991; Wheeler and McFeely, 1991; van der Heyden, 1992; Monger and others, 1994

ua **Upper Amur sedimentary assemblage (Jurassic) (Northwestern part of Russian Southeast, unit Js)**—Consists chiefly of Jurassic shallow-water marine and continental clastic rocks (Uralovskinsk, Uskalinsk, Ayaksk, Depsk, and Molchanovsk suites) that link the Gar, Gonzha, and Oldoi terranes. **REFERENCES:** Krasny, 1966; Volsky, 1983; Kozlovsky, 1988

ud **Uda volcanic-plutonic belt (Late Jurassic and Early Cretaceous) (Southern part of Russian Northeast, units Js, Jpf, KJvi, lJvi)**—Consists chiefly of basalt, andesite-basalt, andesite, and tuff that are interlayered with nonmarine sandstone, siltstone, conglomerate, and coal with a Late Jurassic and Early Cretaceous flora. The lower level of the belt that overlaps the southern part of the eastern Stanovoy block (unit NSS) and may be Late Jurassic in age (Zmievsky and others, 1990). Volcanic rocks have K-Ar ages of 118-176 Ma and associated granitic rocks of 150-190 Ma. A Berriasian to Valanginian flora is well developed in the center of the belt (Lebedev and others, 1989). In the extreme north, a Early Cretaceous (Neocomian) flora occurs along with possible Upper Jurassic deposits. The plutonic part of the belt intrudes the southeastern margin of the Stanovoy block of the North Asian craton (unit NSS), the Okhotsk terrane, and the southern margin of the Kular-Nera and Viliga terranes. Also included are Jurassic granitic rocks, including granodiorite, diorite, and granite, that extend to the west along the southern margin of the North Asian craton (unit NSC). The granitic rocks of the belt yield reliable isotopic ages that range from 130 to 200 Ma. **REFERENCES:** Sosunov and others, 1982; Filatova, 1988; Lebedev and others, 1989; Zmievsky and others, 1990

uo **Umlekan-Ogodzhin volcanic-plutonic belt (Jurassic and Cretaceous) (Northeastern part of Russian Southeast, units Js, KJpf, Kpf, Kvi)**—Consists chiefly of: (1) Lower Cretaceous sandstone, conglomerate, and mudstone with sparse flora and freshwater fauna; (2) Lower Cretaceous calc-alkalic andesite, dacite, and tuff that yield K-Ar ages of 112-135 Ma; and (3) Upper Cretaceous alkalic basalt and rhyolite. Intruded by coeval Early Cretaceous granite, granodiorite, diorite, and monzodiorite. Some granitic plutons are probably Late Jurassic, or older because their detritus were shed into the Early Cretaceous part of section. Belt deposited on Gonzha terrane, and on Mamyn and Turan terranes of Bureya superterrane after collision of these terranes with the Tukuringra-Dzhagdinsk terrane. **REFERENCES**: Volsky, 1983; Kozlovsky and others, 1988

uz **Uda-Zeya sedimentary basin (Late Jurassic) (Northern part of Russian Southeast, unit KJs)**—Consists chiefly of Upper Jurassic shallow-marine sandstone, siltstone, and shale, and nonmarine Lower Cretaceous clastic rocks with coal. The structural thickness of the sedimentary rocks is about 3,000 m. The southern margin of the basin is bounded by north-verging thrust faults. The sedimentary basin overlies the Stanovoy block of the North Asian Craton (unit NSS). **REFERENCES**: Kirillova and Turbin, 1979

vk **Verkhoyansk collisional granite belt (Late Jurassic and Early Cretaceous (Southern and western parts of Russian Northeast, unit eKpf)**—Consists chiefly of two major belts, Main collisional granite belt of Late Jurassic to early Neocomian age, and the Northern collisional granite belt of Neocomian age. Main collisional granite belt extends for about 110 km along southwest border of the Kolyma-Omolon superterrane and stitches the superterrane to North Asian craton margin (unit NSV, Verkhoyansk fold belt). Occurs as inclined, sheet-like plutons, up to 200 km long, that are generally conformable with major folds. Younger differentiates are biotite, two-mica, and amphibole-biotite granitic rocks. Ar-Ar ages of granitic rocks range from 134 to 144 Ma. The Northern collisional granite belt extends for about 600 km along northwestern margin of the Kolyma-Omolon superterrane. Belt consists of inclined sheet-like plutons, up to 200 km long, that are generally conformable with major folds. Major lithologies are tonalite, granodiorite, and, less commonly, two mica leucogranite. **REFERENCES**: Flerov and others, 1979; Sobolev and Kolesnichenko, 1979; Bakharev and others, 1988;

Shkodzinsky and others, 1992; Parfenov, 1991; Hackett and others, 1992

wk **West-Kamchatka sedimentary basin (Paleogene and Neogene) (Western Kamchatka Peninsula and adjacent Sea of Okhotsk, unit Czs)**—Consists chiefly of thick, gently folded, littoral-marine and nonmarine Cenozoic coal-bearing deposits up to 6-km thick. Basin contains major, linear, en-echelon folds occur diagonal to general strike of basin. Basin extends for about 650 km and is interpreted as a backarc basin for the central Kamchatka volcanic belt to east. **REFERENCES**: Vlasov, 1964, 1977

wr **Wrangell volcanic field (middle Tertiary to Holocene) (Eastern-southern Alaska, unit QTvi)**—Consists chiefly of andesite and lesser basaltic andesite shield volcanoes, satellitic cones, and andesite and lesser dacite flows, tuff, breccia, volcanic-avalanche deposits, mudflows, and domes of 0 to 20 Ma age. Volcanic field includes major shield volcanoes at Mount Wrangell, Capital Mountain, Mount Sanford, and Tanada Peak, and a composite stratocone at Mount Drum. Volcanic field also includes lesser rhyolite and rhyodacite flows and domes, and basalt and basaltic andesite cinder cones, and associated flows and dikes. Pyroclastic rocks are mainly lithic and crystal tuff with lesser agglomerate and ash. Field displays predominantly calc-alkalic compositional trend. Local associated shallow andesite plutons, dikes, dike swarms, and plugs. Coeval with volcanic part of Aleutian arc to west. Field overlies mainly the Wrangellia superterrane in eastern-southern Alaska. Locally extensively interlayered with Quaternary and Holocene glacial deposits. **REFERENCES:** Richter, 1976; MacKevett, 1978; Richter and others, 1989; Miller and Richter, 1994

DESCRIPTIONS OF CRATON, CRATON MARGIN, OCEANIC PLATE, AND BACK-ARC SPREADING UNITS

Craton and Craton Margin Rock Units

North American Craton and Craton Margin

NAC **Western North American Craton (Archean, Proterozoic, Paleozoic, Mesozoic, and Cenozoic) (East of Canadian Cordillera)**—Consists chiefly of northeast- to north-trending belts of mainly Early Proterozoic (2.38-1.79 Ga) metamorphic and magmatic terranes, with Archean (2.6-3.9 Ga) rocks of the ancient craton near latitude 49° N (Ross, 1991). These rocks are overlain by a thin veneer of Cambrian through Carboniferous strata, and late Mesozoic and early Tertiary foreland basin deposits; most of the latter are not depicted on map. Numerous hiatuses occur in the Paleozoic and Mesozoic sedimentary rocks on the craton. The craton crust is about 40 km thick.

The craton north of latitude 44° N was assembled in the Early Proterozoic (at about 1.7 Ga) from Archean juvenile crust and continental-margin arcs with ages of ≥ 2.6 Ga. The craton has a northeast- to north-trending structural grain which is truncated by the Cordillera (Hoffman, 1989; Ross, 1991). Towards the end of the Middle Proterozoic, the Early Proterozoic collage became part of a supercontinent called Rodinia, which was probably rifted and separated at about 750 Ma to form the craton margin onto which the various terranes of the Canadian Cordillera were accreted. Stratigraphic column is for the interior Alberta platform. **REFERENCES**: Hoffman, 1989; Ross, 1991; Wheeler and McFeeley, 1991; Stott and Aitken, 1993

NAM **North America Craton Margin (Proterozoic, Paleozoic, and early Mesozoic) (Between North American Craton and terranes of Canadian Cordillera)**—Consists chiefly of: (1) Middle Proterozoic passive continental margin strata; predominantly shallow water clastic and carbonate rocks (Muskwa, Purcell, Wernecke and correlative assemblages); (2) Middle and Late Proterozoic strata, predominantly platformal continental margin; shallow water clastic and carbonate rocks (Mackenzie Mountains and correlative assemblages); (3) Late Proterozoic: rift strata, predominantly clastic continental margin sedimentary rocks; silicic turbidite, diamictite, tillite, conglomerate, and minor mafic volcanic rocks (Rapitan and correlative assemblages) that are succeeded by turbiditic quartz-feldspar grit, shale, and limestone (Windermere and correlative assemblages); (4) Late Proterozoic and Early Cambrian rift strata, predominantly shallow-marine, passive continental margin sedimentary rocks, mainly orthoquartzite and feldspathic quartzite (Gog and Hyland assemblages); (5) Early Cambrian to Carboniferous passive continental margin sedimentary rocks; manly shallow-marine shelf carbonate and clastic rocks that grade westward into offshelf shale, siltstone, and minor limestone with minor mafic volcanic rocks; (6) Devonian and Mississippian fault-trough clastic wedge strata in the central Yukon Territory to central British Columbia that consist of westerly-derived chert-pebble conglomerate, chert sandstone, and shale with minor carbonate rocks (Earn assemblage); and distal clastic wedge strata in the northern Yukon Territory

(Imperial assemblage) that consist of northerly-derived turbiditic sandstone and shale. Both wedges are succeeded by mid-Mississippian deltaic to marine quartz sandstone and shale (Mattson assemblage); And (7) a Pennsylvanian to Jurassic: continental margin prism, mainly chert, shale, sandstone, and carbonate rocks. Stratigraphic column depicts the central part of the craton margin.

The westward thickening wedge comprised by the North American craton margin was presumably deposited above an extended and thinned continental and(?) oceanic crust. The craton margin strata grade eastward into a thinner, shallower water, and far less complete succession deposited on the North American craton. **REFERENCE**: Wheeler and McFeely, 1991

North Asian Craton and Craton Margin (Western part of Russian Far East)—Stable rigid core of northern Asia. Includes the eastern part of the Siberian platform (unit NSC), the Verkhoyansk foldbelt to the east that is underlain by craton (unit NSV), and the uplifted Stanovoy block that occurs to the south of the Siberian platform (unit NSS). Paleomagnetic data indicate the craton formed from accretion of major Archean and Proterozoic fragments between about 850 to 650 Ma. **REFERENCE**: Gusev and others, 1985

NSC **North Asian Craton (Archean and Early Proterozoic) (Eastern part of North Asian Craton)**—Consists chiefly of Archean and Early Proterozoic metamorphic basement, and Late Proterozoic, Paleozoic, and Mesozoic sedimentary cover, locally up to 14 km thick. Late Proterozoic and early Paleozoic units consist mainly of limestone, dolomite, marl, shale, siltstone, and sandstone. Middle and Late Devonian and Early Carboniferous units mainly red sandstone, dolomite, conglomerate, gypsum, rock salt, and, in several major rift basins, alkalic basalt flows. Late Paleozoic and Mesozoic units mainly alluvial, marine-littoral, and shallow water sandstone, siltstone, shale, and conglomerate. **REFERENCE**: Gusev and others, 1985

NSS **North Asian Craton - Stanovoy block (Archean and Early Proterozoic) (Western part of Russian Far East)**—Consists chiefly of Archean and Early Proterozoic gneiss and schist. Interpreted either as uplifted and deeply eroded margin of North Asian craton, or possible accreted microcontinent. Separated from Siberian platform by zone of Early Cretaceous transpressional thrust and left-lateral strike-slip faults. **REFERENCES**: Parfenov, 1984; Zonenshain and others, 1990

NSV **North-Asian Craton Margin (Verkhoyansk fold belt) (Paleozoic and early Mesozoic) (West-central part of Russian Far East)**—Consists chiefly of a thick wedge of craton margin deposits up to 20 km thick consisting of Carboniferous, Permian, Triassic, and Jurassic clastic rocks, marine-littoral, deltaic, and shelf deposits that prograde eastward. Deposited on passive margin of the North Asian continent. Major units grade successively eastward into turbidite deposits and deep-water black shale. Local Middle to Late Devonian and Tournaisian, rift-related deposits similar to those on Siberian platform. Local Early Triassic and Early Jurassic alkalic basalt flows and basalt dikes and sills. Northern and southern parts of fold belt contains thick, shallow-marine carbonate and clastic deposits of Late Proterozoic and early Paleozoic age that become finer-grained and thicker to east. Sedimentary rocks of the fold belt are apparently tectonically detached from crystalline basement of craton. The fold belt is separated from the Siberian platform by Late Cretaceous, west-verging thrust belt. For paleomagnetic determinations, two localities of Lower Triassic and Middle to Upper Triassic sedimentary rocks yield grade C results, indicating $-6^{\circ}\pm7^{\circ}$ northward and $23^{\circ}\pm18^{\circ}$ southward displacements with respect to the Siberian platform. **REFERENCES**: Slautsitais, 1971; Bulgakova and others, 1979; Natapov, 1984; Parfenov, 1984, 1985, 1987; 1991; Prokopiev, 1989; Parfenov and Prokopiev, 1993

Active Spreading Seafloor and Cenozoic Oceanic Plates Actively Spreading Seafloor (Pacific Ocean)

JA **Juan de Fuca plate (Cenozoic) (Eastern Pacific Ocean)**—Located offshore U.S.A. Pacific Northwest and British Columbia east of the Juan de Fuca ridge. Chiefly Eocene and Miocene oceanic crust up to a few km thick overlain by Pliocene and younger abyssal-plain turbidites, submarine-fan deposits, and sand, gravel, glacial-marine sediment, and silt turbidites. Clastic sedimentary rocks derived from igneous, metamorphic, and sedimentary sources on the adjacent North American continent. Juan de Fuca plate bounded to northeast by present-day subduction zone of Cascadia megathrust. **REFERENCES**: Atwater, 1989; Atwater, and Severinghaus, 1989; Duncan and Kulm, 1989

PAC **Pacific plate (Cenozoic) (Pacific Ocean)**—Located west of Juan de Fuca ridge. Within the map area, consists chiefly of late Eocene to late Miocene oceanic crust 7 to 10 km thick overlain by as much as

2.5 km of Eocene to Holocene pelagic, hemipelagic, continental-rise, and glaciomarine deposits. Seismic refraction data indicate that oceanic mantle is overlain by layer 3 about 5 km thick, layer 2 about 1 to 1.5 km thick, and layer 1, from less 200 m thick in areas distant from the continent, to more than 2 km thick near the continental margin. Outside of map area, contains chains of seamounts (Gilbert, Kodiak, and Patton), fracture zones (Aia, Blanco, Sila, Sedna, Surveyor, Sovano), and oceanic spreading ridge (Juan de Fuca) south of southeastern Alaska. **REFERENCES**: Atwater, and Severinghaus, 1989; Grantz and others, 1991; Kirschner, 1988, 1994

Eurasia Plate (Laptev Sea))

NAN **Nansen Basin (Cenozoic) (Laptev Sea)**—Underlies the Eurasia Basin of the Arctic Ocean between the Mid-Arctic ridge, the actively spreading boundary between the Eurasia and North American Plates in the Arctic Ocean, and the continental slope of the Barents Sea. The seafloor defines a morphologic basin in the area of the Nansen basin (Barents plain) that is locally between 3,900 and 4,000 m deep. Oceanic crust in the in the Nansen Basin is overlain by a wedge-shaped sedimentary prism that laps out against the basalt of the Mid-Arctic ridge and thickens toward the continental rocks of the Barents slope. Sedimentary rocks in the basin are more than 3 km thick in a zone adjacent to the Barents slope that is 80 to 165 km wide. Seismic-reflection data suggest that the section is dominated by turbidite and hemipelagic deposits. The basal unit infills basin lows and drapes over basement highs; an intermediate unit is characterized by interfingering and truncated reflectors and is interpreted as turbidite deposits; and the uppermost unit is acoustically transparent and is thought to consist mainly of hemipelagic deposits with subordinate turbidite deposits. The upper unit is about 200 or 300 m thick.

The Nansen and Amundsen basins are separated by the Gakkel (Arctic Midocean) Ridge of late Paleocene to Quaternary age that is the spreading axis and modern boundary of the Eurasian and North American plates. To the south, the ridge changes into the intracontinental Mamskaia rift zone. The Gakkel (Arctic Midocean) Ridge is deep compared to other midocean ridges; in some localities over 3 km deep, possibly indicating a passive nature. Along the ridge are anomalies 1 to 24, indicating that opening of the Eurasian oceanic basin started at about 56 Ma. A zone of seismicity is clearly observed along the ridge and continues onto the continent. **REFERENCES:** Karasik, 1980; Savostin and Drachiov, 1988; Kristoffersen, 1990; Zonenshain and others, 1990

North American Plate (Laptev Sea)

AN **Amundsen Basin (Cenozoic) (Laptev Sea)**—Forms North American Plate counterpart of the Nansen Basin of the Eurasia Plate. Located between the plate boundary at the Gakkel (Arctic Midocean) Ridge on the west and the Lomonosov Ridge on the east. Like the Nansen Basin, the seafloor over the Amundsen Basin defines a morphologic basin (the Pole plain), except near the Laptev shelf, where it merges with the continental rise sedimentary prism that extends into the Eurasia Basin north of the Lena River delta. Because of being largely isolated from sediment sources on the Barents shelf by the Gakkel Ridge, the seafloor of the Amundsen basin is deeper than that of the Nansen basin, and basinal morphology is thereby better developed. The seafloor is more than 4,000 m deep over most of the Amundsen Basin, and a large area is more than 4,400 m deep. Where the Laptev continental rise sedimentary prism overlaps and obscures the Mid-Arctic Ridge, the boundary between the Amundsen and Nansen Basins is placed along the projection of the midocean ridge beneath the continental rise.

Reconnaissance seismic-refraction data suggest that the oceanic crust ranges in thickness from 3 to 7 km and formed at about 58 Ma. The sedimentary prism in the Amundsen Basin is generally thinner than in the Nansen Basin. The prism laps out against the Mid-Arctic Ridge and thickens northward to a little more than 3,000 m at the foot of the Lomonosov Ridge. Subseafloor beds below about 600 to 800 m appear laminated on seismic-reflection records, and may contain distal turbidite deposits. Overlying these beds is an acoustically transparent unit that may consist mainly of hemipelagic sedimentary rocks. The lithology of the uppermost unit in Amundsen Basin may corresponds to the uppermost unit of the Nansen Basin section, which is 200 or 300 m thick, and is inferred to consist of hemipelagic deposits. In the Amundsen Basin, ambiguous closely spaced seismic reflectors suggest that turbidite deposits may also be present in the uppermost unit. **REFERENCE:** Kristoffersen, 1990

Bering Sea

KME, KMW **Komandorsky Plates, East and West (early Miocene) (Komandorsky Basin, Western Bering Sea)**—The east and west Komandorsky plates consist chiefly of oceanic crust, mainly early Miocene basalt and sedimentary rocks that are overlain by younger ocean floor sedimentary rocks. Geophysical surveys reveal a series of north-northeast-striking oceanic spreading ridges that are offset by west-northwest-striking fracture zones. The formation of the oceanic plates in the Komandorsky

Basin is estimated to be from the time of anomaly 6 or older to anomaly 5 which explains the high heat flow of the basin. A trench filled with 3-4 km of Miocene and younger sedimentary rocks is located along the western edge of the basin.

The west-northwest-striking fracture zones that extend from the continental slope of Kamchatka Peninsula eastward to the Shirshov Ridge are transform faults that formed during opening of Komandorsky Basin. Most of the eastern part of the Komandorsky Basin is underlain by extensionally thinned crust of the former Shirshov arc of early Tertiary age. Structural and magnetic data define the following fracture zones, from south to north: Bering, Alpha, Beta 1, Beta 2, Gamma, and Delta. The Beringa fracture zone, similar to the San Andreas fault system of California, is presently part of the system of transform faults forming the boundary between the Pacific and North American plates. The Steller shear zone, south of the Komandorsky Islands is a similar plate-boundary shear zone. Focal mechanism solutions and structural data show that Steller, Beringa, and Alpha fracture zones exhibit mainly dextral-slip movement. The various parts of the Komandorsky plates between fracture zones are characterized by different structural styles depending upon spreading velocity and width of opening. All of the spreading-axis segments except the southern most one, which is occupied by a volcanic massif and flanking graben, are covered by late Cenozoic sedimentary rocks. **REFERENCE**: Baranov and others, 1991

Back-Arc Spreading Units

KR **Kuril back-arc unit (Cenozoic) (Southeastern Sea of Okhotsk, unit Czsv)**—Direct data on nature and age of this back-arc unit are absent. The central and northern parts of the unit are interpreted as Oligocene to Miocene oceanic crust with an average seismic velocity of 6.7 to 7.0 km/s, a thickness of 12-13 km, and a thin upper layer of sedimentary rocks on the basis of inferred slow sedimentation rates (Zonenshain and others, 1990) and heat flow values that are 2 to 2.5 times higher than in modern oceans. The southern part of unit is interpreted as a back-arc unit that started to form at about 15 Ma. In some parts of unit, partly buried volcanic cones are overlain by sedimentary rocks. Dredging from the eastern part of the unit on the western slope of Kuril island arc yields granitic rocks, ranging in age from 94 to 219 Ma and granitic clasts in conglomerate associated with Paleogene volcanic rocks. These rocks are exotic to the Kuril arc, but very much similar to those dredged from the Academy of Sciences uplift. Spreading in the Kuril basin may have partially split the Academy of Sciences collage. **REFERENCES**: Kornev and others, 1982; Gnibidenko and Svarichevsky, 1984; Sergeev and Krasny, 1987; Zonenshain and others, 1990; Maeda, 1990

SJ **Sea of Japan back-arc unit (Cenozoic) (Sea of Japan, unit QTb)**—Consists chiefly of volcanic rocks ranging from basalt to trachyrhyolite as dredged from seamounts and ridges. Tholeiitic basalt forms about 80-90% of total dredged material, along with sparse clinopyroxene-olivine ferrobasalt. The basalt commonly contains lehrzolite xenoliths with a predominant olivine-plagioclase assemblage and subordinate chromium clinopyroxene and chrome spinel. The tholeiitic basalt is similar in geochemistry to basalt of oceanic spreading zones, differing with slightly higher Rb and Sr contents. The age of basalt is tentatively estimated as 0 to 15 Ma. The time of opening of the Japan Sea as determined by paleomagnetic data. Basalts are overlapped by a sedimentary cover up to 2 km thick. Seismic surveys indicate the sedimentary cover consists of two sequences, an upper, acoustically stratified sequence, and a lower, acoustically uniform sequence. P-wave velocity in the upper sequence ranges from 1.6 to 2.1 km/s, and in the lower sequence ranges from 2.3 to 3.4 km/s. Deep drilling (IPOD) holes numbers 300 to 302 in the southern part of the Central Basin penetrated 531 m of Miocene-Pleistocene turbidite. **REFERENCES**: Bersenev and others, 1987; Ingle and others, 1975

DESCRIPTION OF TECTONOSTRATIGRAPHIC TERRANES

[Arranged alphabetically by map symbol; inferred tectonic environment in parentheses]

AA **Aleutia terrane (oceanic crust) (Probable Cretaceous and early Tertiary) (Northern Pacific Ocean and Bering Sea)**—Consists chiefly of an oceanic basalt basement that is probably the oceanic Kula plate. Underlies the Aleutian-Bowers Basin (unit atb) and Shirshov Ridge volcanic belt (unit sh). Includes Late Cretaceous and early Tertiary oceanic (pelagic and hemipelagic) sedimentary rocks. Includes possible subterranes, such as Citus Ridge, a potential early Eocene northwest-trending spreading axis in the western Aleutian Basin. Overlap assemblages formed on Aleutia include: (1) Eocene to Holocene sedimentary rocks of the Aleutian-Bowers Basin; and (2) the Aleutian arc (unit al), Bowers Ridge volcanic belt (unit bw), and Shirshov Ridge volcanic belt (unit sh). Aleutian terrane bordered on the north by Bering

Shelf collage, to the south by the Aleutian megathrust and to the west by rifted crust of the Komandorsky Basin and Shirshov terrane. **REFERENCES**: Cooper and others, 1992; Scholl and others, 1992

Arctic Alaska superterrane (Northern Alaska)—Consists chiefly of Endicott Mountains, De Long Mountains, Hammond, North Slope, and Tigara terranes. Coldfoot terrane (Moore, 1992; Moore and others, 1992) designated as terrane separate from Arctic Alaska superterrane in this study. North Slope terrane occurs along northern margin of Arctic Alaska whereas the Endicott Mountains, De Long Mountains, and Hammond terranes occur generally successively to south. Tigara terrane occurs in western Arctic Alaska. Arctic Alaska superterrane overlain by Upper Cretaceous marine sedimentary rocks, and by Cenozoic marine and nonmarine sedimentary rocks. Various terranes of Arctic Alaska terrane are interpreted as originally forming in a passive continental margin environment that subsequently was substantially tectonically imbricated during major Mesozoic thrusting followed by extension and younger Cretaceous and Cenozoic shortening along the southern margin (Moore, 1992; Moore and others, 1992). **REFERENCES:** Moore, 1992; Moore and others, 1992

AAD **De Long Mountains terrane (passive continental margin) (Brooks Range, Alaska)**—Consists chiefly of at least four allochthonous sequences that are composed of Late Devonian or Early Mississippian to Early Cretaceous sedimentary rocks and that are distinguished by various stratigraphic characteristics. The terrane typically consists of: (1) Upper Devonian carbonate rocks (Baird Group, part); (2) Lower Mississippian shallow marine clastic rocks and black shale (Kayak Shale of Endicott Group); (3) Lower Pennsylvanian through Jurassic chert and argillite (Etivluk Group), and Mississippian carbonate platform rocks (Lisburne Group); and (4) Upper Jurassic and Early Cretaceous (Neocomian) flysch (Okpikruak Formation). Individual allochthonous sequences distinguished by: (1) presence or absence of Upper Devonian and Mississippian arkosic debris (Nuka Formation) containing 2.06 Ga clastic zircons; (2) Mississippian and Early Pennsylvanian shallow-marine carbonate platform deposits (Lisburne Group); (3) abundant Permian(?) diabase sills intruding late Paleozoic strata; and (4) a proportion of clastic material within siliceous Permian, Triassic, and Early Jurassic deposits (Etivluk Group). De Long Mountains terrane structurally overlies Endicott Mountains terrane and is interpreted as displaced fragments of the outer part of the late Paleozoic and early Mesozoic Arctic passive continental margin of North America. **REFERENCES**: Jones and others, 1981, 1987; Dumoulin and Harris, 1987; Mayfield and others, 1988; Karl and others, 1989; Moore and Mull, 1989; Moore and others, 1992

AAE **Endicott Mountains terrane (passive continental margin) (Brooks Range, Alaska)**—Consists chiefly of: (1) Upper Devonian marine shale and sandstone (Hunt Fork Shale, Noatak Sandstone) grading upward into thick coarse-grained uppermost Devonian and lowermost Mississippian(?) fluvial deposits (Kanayut Conglomerate), and capped by transgressive marine shale (Kayak Shale). These units comprise the Endicott Group and represent a fluvial-deltaic clastic wedge shed from a northern and eastern source area (present-day coordinates); (2) Mississippian and Pennsylvanian passive continental-margin carbonate-platform deposits (Lisburne Group), and Mississippian and Pennsylvanian shale, chert, dolomite, and sparse marine keratophyre flow and tuff (Kuna Formation); (3) Permian to Jurassic siliceous argillite, chert, and silicified limestone (Siksikpuk and Otuk Formations); (4) Jurassic to Lower Cretaceous (Neocomian) shale (Ipewik unit) containing a thin, but extensive *Buchia* coquina unit; and (5) Neocomian (Okpikruak Formation) and Albian (Fortress Mountain and Torok Formations) flysch and lutite. The terrane displays chlorite-grade greenschist facies metamorphism of Mesozoic age along southern margin. The terrane structurally overlies Hammond and North Slope terranes and underlies De Long Mountains terrane. Endicott Mountains terrane interpreted as displaced fragment of the Paleozoic and early Mesozoic Arctic continental margin of North America. Includes Kagvik terrane of Churkin and others (1979). **REFERENCES**: Dutro and others (1976); Churkin and others, 1979; Jones and others, 1981, 1987; Mull and others, 1982; Nokleberg and Winkler, 1982; Mayfield and others, 1978, 1988; Nilsen, 1981; Karl and others, 1989; Moore and Mull, 1989; Moore and others, 1992

AAH **Hammond terrane (passive continental margin) (Brooks Range, Alaska)**—Consists chiefly of four complexly imbricated assemblages: (1) Upper(?) Proterozoic quartz-mica schist, quartzite, marble, calc-schist, metabasalt, and phyllite; (2) metamorphosed Cambrian to Silurian and older carbonate rocks (Skajit Limestone and undifferentiated Baird Group); (3) Devonian phyllite, metasandstone, metaconglomerate, metatuff, metabasalt, and limestone (including the Beaucoup

Formation) and upper Paleozoic (Mississippian) conglomerate and black shale (Kekiktuk and Kayak Formations); (4) sparse Mississippian and Pennsylvanian(?) carbonate platform rocks (Lisburne Group); and (5) sparse siltstone of Permian(?) and Triassic(?) age of the Saddlerochit(?) Group. Older two assemblages locally intruded by Late Proterozoic and Devonian gneissic granitic rocks. The Hammond terrane is characterized by widespread presence of the second assemblage and a strong structural fabric that overprints relict primary sedimentary structures. Oldest assemblage exposed in local structural highs. Late Paleozoic sequence correlative with coeval stable shelf deposits of the North Slope terrane. The Hammond terrane displays mainly chlorite-grade greenschist facies metamorphism and relatively older blueschist- and amphibolite-facies metamorphism. The Hammond terrane is interpreted as a composite of several terranes displaced from unknown early Paleozoic carbonate platforms and clastic basins along the North American(?) or Siberian(?) continental margins. Hammond terrane structurally underlies Endicott Mountains and Coldfoot terranes. **REFERENCES**: Tailleur and others, 1977; Dillon and others, 1980, 1987; Jones and others, 1981, 1987; Dumoulin and Harris, 1987; Dillon, 1989; Karl and others, 1989; Moore and Mull, 1989; Moore and others, 1992

AAN **North Slope terrane (passive continental margin) (North Slope and eastern Brooks Range, Alaska)**—Located in North Slope subsurface, northeastern Brooks Range, and Doonerak structural window, and consists of three major sequences: Franklinian sequence (pre-Mississippian), Ellesmerian sequence (Mississippian to Early Cretaceous), and Brookian sequence (mid-Cretaceous and Cenozoic).

Franklinian assemblage is commonly complexly deformed, stratigraphically complicated, and may be a composite of several terranes. The best studied part (illustrated in stratigraphic column) occurs in Sadlerochit Mountains, on the north flank of the northeastern Brooks Range, and consists of a carbonate platform to basin assemblage composed of: (1) Katakturuk Dolomite (Proterozoic), Nanook Limestone (Proterozoic? or lower Cambrian to Ordovician); and (2) Mount Copleston Limestone (Early Devonian). Pre-Mississippian rocks elsewhere in terrane consist of Late Proterozoic through middle Devonian slate, phyllite, chert, graywacke, carbonate rocks, mafic and intermediate volcanic and volcaniclastic rocks, and the Neruokpuk Quartzite. Franklinian sequence contains sparse Devonian metagranitic plutons.

Ellesmerian sequence unconformably overlies Franklinian sequence and consists of: (1) transgressive unit of Mississippian nonmarine conglomerate and marine shale (Kayak Shale and Kekiktuk Conglomerate of Endicott Group); (2) Mississippian to Permian carbonate platform deposits (Lisburne Group); (3) Permian and Triassic marine shale, sandstone, and conglomerate (Echooka Formation and Ivishak Formation of Sadlerochit Group); (4) Triassic black shale, limestone and quartz-rich sandstone (Shublik Formation) and Jurassic and Early Cretaceous black shale and sparse fine-grained sandstone (Kingak Shale).

Brookian sequence unconformably overlies the Ellesmerian sequence and consists of: (1) mid- to Upper Cretaceous condensed basinal deposits (pebble shale unit and the Hue Shale); and (2) northeast-prograding fluvial deltaic deposits of mid-Cretaceous (Fortress Mountain Formation, Torok Formation, Nanushuk Group), Upper Cretaceous, and Tertiary age (Canning Formation, Colville Group, Sagavanirktok Formation). . Prograding fluvial-deltaic deposits contain a regional Cenomanian disconformity.

For paleomagnetic determinations, almost all the reported data for Arctic Alaska shows evidence of magnetic overprinting. Only two localities yield results that appear to have seen through this overprint. Lower Cretaceous sedimentary rocks from the Kuparuk oil field yield grade A results which indicate a rotation that fits with an origin for Arctic Alaska adjacent to the Canadian Arctic margin, and an $18^{o}\pm4^{o}$ displacement with respect to North America. The other grade B data set is for mid-Cretaceous age sedimentary rocks, and indicates about a $10^{o}\pm8^{o}$ southerly displacement. However, because the pole is very close to the sampling sites, the direction of the displacement is hard to determine.

The North Slope terrane is structurally overlain by Endicott Mountains and De Long Mountains terranes. The base of the terrane is not exposed. The North Slope terrane is interpreted as a displaced fragment of the Paleozoic and early Mesozoic Arctic continental margin of North America. **REFERENCES**: Brosgé and others, 1962; Brosgé and Tailleur, 1970; Jones and others, 1981, 1987; Mull and others, 198: Witte and others, 1987; Halgedahl and Jarrard, 19872; Bird, 1985, 1988; Blodgett and others, 1986, 1988, 1992; Witte and others, 1987; Halgedahl and Jarrard, 1987; Mayfield and others, 1988; Moore and Mull, 1989; Grantz and others, 1990; Moore and others, 1992

AAT **Tigara terrane (passive continental margin) (Northwestern Alaska and western Seward Peninsula)**—Consists chiefly of orogenic deposits unconformably overlain by stable shelf deposits. These deposits are: (1) Ordovician and Silurian slaty argillite, graptolitic shale, and graywacke turbidite deposits of the Iviagik Group (Martin, 1970) that are more than 1,500 m thick; (2) unconformably overlying, Lower Mississippian, intercalated marine and nonmarine argillite, lutite, quartzite, and coal of the Kapaloak sequence that is more than 600 m thick; (3) Lower(?) Mississippian marine shale (similar to Kayak Shale) and Lower Mississippian to Pennsylvanian carbonate rocks of the Nasorak, Kogruk, and Tupik Formations of the 2,000-m-thick Lisburne Group; (4) Pennsylvanian to Jurassic argillite, siliceous shale, limestone, and argillaceous chert of the 2,000-m-thick Etivluk Group; and (5) Late Jurassic(?) to Neocomian marine graywacke turbidite and marine mudstone of the Ogotoruk, Telavirak, and Kismilok Formations that together are more than 5,100 m thick. Tigara terrane inferred to be conformably overlapped by the deposits of the Colville Basin, including marine turbidite sandstone and mudstone that may be part of the Albian Fortress Mountain Formation. Tigara terrane resembles to a greater degree the North Slope terrane and to a lesser degree the Endicott Mountains terrane (Jones and others, 1987). Tigara terrane may extend offshore to at least part of the adjacent Herald Arch of the central Chukchi Sea. In western Brooks Range, the Tigara terrane may be thrust over Cretaceous sedimentary rocks to east; in western Seward Peninsula, thrust over York terrane to east. Tigara terrane interpreted as a fragment of the displaced Paleozoic and early Mesozoic Arctic continental margin of North America. **REFERENCES**: Campbell, 1967; Martin, 1970; Jones and others, 1981, 1987; Murchey and others, 1988; Grantz and others, 1983, 1991; Moore and others, 1992

AG **Angayucham terrane (subduction zone - predominantly oceanic rocks) (East- and West-Central, Alaska, and Brooks Range)**—Exposed in elongate belts and large klippen. Divided into lower (Slate Creek), middle (Narvak), and upper (Kanuti) thrust panels.

Lower (Slate Creek) thrust panel—Consists chiefly of phyllonite, melange, and sedimentary broken formation. Sedimentary part consists mainly of thin-bedded, quartz, and chert-rich graywacke turbidite deposits of continental derivation, chert, phyllite, and slate. Contains local tectonic blocks of volcanic rocks, chert, limestone turbidite, chert-pebble conglomerate, and shallow-marine clastic deposits. Contains palynomorphs, conodonts, radiolarians, brachiopods and plant fragments ranging in age from Devonian to Early Jurassic. Locally to pervasively deformed and metamorphosed to lower greenschist facies in the Mesozoic, particularly along northern margin where phyllonite is common. Slate Creek thrust panel includes both Prospect Creek, Slate Creek, and Venetie terranes of Grantz and others (1991) and Moore and others (1992); interpreted as a tectonic unit that separates the structurally underlying, regionally metamorphosed and deformed rocks of Coldfoot, Endicott, Hammond Mountains, and Ruby terranes from overthrust oceanic rocks of Narvak thrust panel. **REFERENCES**: Jones and others, 1987; Murphy and Patton, 1988; Moore and Mull, 1989; Moore and Murphy, 1989; Dover, 1990; Grantz and others, 1991; Patton, 1992a, b; Moore and others, 1992; Patton and others, 1992, 1994

Middle (Narvak) thrust panel—Consists chiefly of structurally interleaved diabase, pillow basalt, tuff, chert, graywacke, argillite, minor limestone, and volcanogenic sandstone, conglomerate, and tuff. Locally abundant gabbro and diabase. Cherts range in age from Late Devonian to Early Jurassic. Limestone is mainly Carboniferous. Devonian corals, brachiopods, and graptolites from shale and limestone beds in extreme east-central Alaska. Interpreted as major accumulations of late Carboniferous and Late Triassic basaltic volcanism; however, many volcanic sequences are not yet well dated. Basalt interpreted as oceanic island or plateau basalt based on associated sedimentary facies and trace-element discriminate patterns. Includes Tozitna, Innoko, and Woodchopper Canyon terranes of Jones and others (1981, 1987) and Grantz and others (1991), and Rampart Group of east-central Alaska.

Narvak thrust panel structurally and stratigraphically complex; generally highly faulted and locally folded. Metamorphosed to greenschist facies and locally blueschist facies at base of thrust panel. Narvak and Slate Creek thrust panels structurally overlie the Coldfoot terrane to north and Ruby terrane to south; and are structurally overlain by Kanuti thrust panel and Koyukuk terrane. Locally in southwestern Alaska, protolith forms stratigraphic basement to Koyukuk terrane. Narvak thrust panel depositionally overlain by Cretaceous clastic deposits of Yukon-Koyukuk Basin, and by Late Cretaceous and early Tertiary Yukon-Kanuti and Kuskokwim Mountains igneous belts. Narvak thrust panel interpreted as a subduction-zone complex composed chiefly of oceanic crust and seamounts. Locally in southwestern Alaska, Narvak thrust panel may be stratigraphically overlain by rocks of Koyukuk terrane. **REFERENCES**: Brosgé and others, 1969; Murchey and Harris, 1985; Barker and others, 1988; Jones and others, 1988; Pallister and Carlson, 1988; Pallister and others, 1989; Patton and others, 1977, 1992, 1994; Patton, 1992a, b

Upper (Kanuti) thrust panel—Consists chiefly of serpentinized pyroxenite, harzburgite, dunite, wehrlite, cumulate gabbro, non-cumulate gabbro, and diabase. Basal contact of ophiolite locally marked by amphibolite metamorphosed at the time of structural emplacement in the Middle Jurassic (Boak and others, 1987). Includes Misheguk Mountain terrane of Grantz and others (1991) and other isolated klippen of ultramafic and mafic rocks that structurally overlie the Narvak thrust panel. Kanuti thrust panel interpreted as the basal part of an ophiolitic assemblage emplaced during Middle or Late Jurassic onto an apparently unrelated middle (Narvak) thrust panel of basalt. Kanuti thrust panel interpreted as the root of an island arc, possibly the tectonically suprajacent Koyukuk terrane. **REFERENCES**: Patton and others, 1977, 1992, 1994; Wirth and others, 1986; Boak and others, 1987; Loney and Himmelberg, 1985, 1989; Mayfield and others, 1988; Karl, 1992; Patton, 1992a, b

AK **Avekova terrane (cratonal) (East-central part of Russian Northeast)**—Consists chiefly of gneiss, crystalline schist, and carbonate rocks with amphibolite- and granulite-facies metamorphism. Zircon from gneiss dated at 2.8 Ga, whereas that from the basic crystalline schist dated at 1.9 Ga. Rb-Sr age of granite is 2.04 to 1.78 Ga. Younger units are: (1) gently dipping quartzite, phyllite, and stromatolite limestone of a presumed Late Proterozoic age; (2) trachyrhyolite, basalt, shale, and chert metamorphosed at greenschist facies during the Late Devonian to Early Carboniferous according to a Rb-Sr age; and (3) limestone, shale, and sandstone with late Paleozoic corals that are presumably overlain by Late Jurassic sandstone and conglomerate. **REFERENCES**: Bibikova and others, 1981; Zhulanova, 1990; Mishkin and others, 1989

AM **Amur River terrane (accretionary wedge - predominantly turbidites) (Northern part of Russian Southeast)**—Located between Kiselyovka-Manoma and Khabarovsk terranes and consists of: (1) abundant Cretaceous turbidite deposits (Largasinsk, Uktursk, Pionersk, and Pivansk suites); and (2) subordinate Late Jurassic hemipelagic siliceous shale. Turbidite deposits form thick horizons of olistostromes, contain macrofossils of Berriasian-Valanginian to Albian-Cenomanian age, and are interpreted as trench sedimentary rocks. The terrane occurs in an imbricate stack of southeast-verging thrust sheets and slices. Thrusting is interpreted as coeval with sedimentation. During accretion, subduction-related folds, and thrusts, and sinstral strike-slip deformation occurred throughout the Amur River terrane and the adjacent Khabarovsk and Kiselevka-Manoma terranes. Postaccretion units consist of Senonian and Paleogene, calc-alkalic volcanic and sedimentary rocks (unit es), and Neogene-Quaternary, rift-related alkalic basalt and nonmarine tholeiite (unit sp). Amur River terrane interpreted as an accretionary wedge unit tectonically paired to the Khingan-Okhotsk active continental margin. **REFERENCES**: Natal'in and Aleseenko, 1989, Krasny, 1966

AN **Anui terrane (metamorphosed continental margin) (Eastern part of Russian Southeast)**—Occurs in a tectonic window within the Samarka terrane. The terrane consists chiefly of pelitic schist, gneiss, migmatite, and rare amphibolite. The terrane is metamorphosed to amphibolite facies that yield K-Ar ages of 488 and 417 Ma. Metamorphic rocks are possibly a gneiss-dome complex. Structurally overlain by an ophiolite nappe composed of ultramafic and plutonic rocks, mafic metavolcanic rocks, and microquartzites of the Samarka terrane. Anui terrane and overlying ophiolite nappe intruded by mid-Cretaceous, two-mica, garnet- and cordierite-bearing granitic rocks. Xenoliths of metamorphic rocks, interpreted as fragments of the Anui terrane, are widespread in similar granitic rocks in the Central Sikhote-Alin region, and suggest that the Anui terrane occurs regionally underneath the Samarka terrane. Anui terrane is interpreted as a microcontinent that collided with the Jurassic accretionary wedge of the Samarka terrane. **REFERENCES**: Zmievsky, 1980, Natal'in and others, unpublished data, 1990, Natal'in, 1991; Faure and Natal'in, 1992

ANV **Aniva terrane (subduction zone - predominantly oceanic rocks) (Sakhalin Island, Russian Southeast)**—Consists chiefly of a melange consisting of: (1) lenses of Middle Triassic, Jurassic, and Early Cretaceous oceanic high-titanium tholeiite, alkalic basalt, and chert; (2) fragments of guyots with late Paleozoic and Late Triassic limestone caps; (3) local exotic bodies of intensely metamorphosed ultramafic and mafic rocks; and (4) a matrix of Albian to Cenomanian turbidite and olistostromes. Individual cherty bodies range from early Middle Triassic to early Cenomanian as determined by radiolarian and conodont assemblages. Complexly folded and faulted and metamorphosed to transitional blueschist-greenschist facies. K-Ar white mica age of 54 Ma. Collisional biotite granite intruded after metamorphism. The Aniva terrane is correlated in part with Hidaka terrane of Hokkaido Island. The Aniva terrane is tectonically paired to the East Sikhote-Alin volcanic-plutonic belt. **REFERENCES**: Geology of the U.S.S.R., Sakhalin Island, 1970; Dobretsov, 1978; Rikhter, 1986; Khanchuk and others, 1988; Bekhtold and Semenov, 1990

AP **Aurora Peak terrane (continental-margin arc) (Eastern and central Alaska Range, Alaska)**—Consists chiefly of Silurian through Triassic metasedimentary rocks, and Late Cretaceous and early Tertiary metagranitic rocks. Older metasedimentary rocks consist mainly of fine- to medium-grained and polydeformed calc-schist, marble, quartzite, and pelitic schist. One conodont fragment from marble indicates a Silurian to Triassic age. Protoliths for metasedimentary rocks include marl, quartzite, and shale. Younger metaplutonic sequence (unit Kpf) consists of regionally metamorphosed and penetratively deformed schistose quartz diorite with granodiorite, granite, and sparse amphibolite derived from gabbro and diorite. U-Pb zircon and Rb-Sr whole-rock isochron isotopic analyses of the metaplutonic rocks indicate emplacement ages of 71 and 74 Ma. Isotopic analysis of lead from samples of metagranitic rocks yield moderate radiogenic values, and derivation from a source with an age of about 1.2 Ga.

Minimum structural thickness of terrane several thousand meters. The terrane was twice ductily metamorphosed and deformed. Core of terrane exhibits older, upper amphibolite-facies metamorphism and associated mylonitic schist. Upper amphibolite-facies metamorphism probably occurred during syntectonic intrusion of the Late Cretaceous metagranitic rocks. Margin of terrane exhibits younger middle greenschist facies metamorphism and formation of blastomylonite along an intense, younger schistosity. Younger greenschist-facies minerals and younger intense schistosity occur mainly along the margins of the terrane, adjacent to bounding Denali and Nenana Glacier faults. Aurora Peak terrane interpreted as a displaced fragment of a North American continental-margin arc that was tectonically separated from the Kluane Schist and the Ruby Range batholith in southwestern Yukon Territory. **REFERENCES**: Brewer, 1982; Nokleberg and others, 1985, 1989a, 1992, 1994a; Aleinikoff and others, 1987

AR **Arlis terrane (passive continental margin) (age unknown) (Beaufort Sea, Chukchi Sea, and adjacent area)**—Underlies high-standing, flat-topped Arlis Plateau; bathymetric data indicate plateau may be underlain by continental rocks. However, lithologic character is almost unknown. Seismic-reflection data from the east flank of the Arlis Plateau between 78° and 81° N, and from ice island T-3 indicate that the plateau is locally intensely block-faulted in that area and underlain by 0.1 to 1.0 km or more of folded and faulted sediment that rests on acoustic basement. The Arlis terrane may be a fragment of the Henrietta terrane, described below, that was displaced by rifting in the De Long Basin. Aeromagnetic data suggest the Arlis terrane is possibly overlain by rocks of the Alpha-Mendeleev Ridge postaccretion overlap volcanic belt. **REFERENCES**: Vinogradov and others, 1975, 1977; Fujita and Cook, 1990; Hall, 1990; Kos'ko and others, 1990; Grantz and others, 1992

ASC **Academy of Sciences collage (Sea of Okhotsk)**—Defined from suites of rocks dredged from two uplifts of acoustic basement. The first suite consists of granite, granodiorite, quartz diorite, granosyenite, diabase, basalt, andesite, and tuff that yield K-Ar ages ranging from 68 to 117 Ma. Volcanic rocks are calc-alkalic and tholeiitic and are interpreted as part of an island arc. The second suite consists of schist, quartzite, metasandstone, siltstone, and argillite and possible cataclastic granitic rocks, if not ice-rafted, that yield K-Ar ages of 206-209 Ma. Seismic data indicate overlying sedimentary cover is up to 2 km thick and consists of a lower folded Paleogene(?) unit, and an upper Neogene-Quaternary unit. **REFERENCES**: Geodekyan and others, 1976; Kornev and others, 1982; Vasiliyev and others, 1984; Sergeev and Krasny, 1987

ATW **Attu Island part of Prince William terrane (accretionary wedge - predominantly turbidites) (Northern Pacific Ocean)**—Occurs along southern margin of western Aleutian arc and consists predominantly of early Tertiary trench sedimentary rocks accreted to hanging wall of subduction zone. Attu Island part of terrane to exposed on lower landward trench slope near Attu and Kodiak Islands. Mostly late Cenozoic. Attu Island part of terrane grades eastward into Prince William part of terrane in southern Alaska. Refer to description of Prince William terrane (unit PW). Attu Island and Prince William parts of terrane interpreted as forming during Cenozoic underthrusting of southern Alaska continental margin by Kula and

Pacific plates. **REFERENCES:** Cooper and others, 1987, 1992; Scholl and others, 1992; Scholl and Hart, 1994 .

AU **Argun terrane (cratonal) (Western part of Russian Southeast)**—Located south of North Asian craton. Consists chiefly of: (1) Early Archean schist and gneiss metamorphosed to granulite facies and injected by migmatite; (2) Late Archean schist, gneiss, amphibolite, and marble metamorphosed to amphibolite facies; (3) Upper Proterozoic limestone, dolomite, quartz sandstone, shale, siliceous shale, and minor conglomerate that are locally metamorphosed to greenschist or amphibolite facies (Gazimurovsk series); (4) Upper Proterozoic sandstone and shale both metamorphosed up to amphibolite facies (Urovsk suite); (5) Conformably overlying Lower and Middle Cambrian limestone, dolomite, sandstone, and shale (Bystrinsk suite); (6) Lower and Middle Devonian limestone, dolomite with minor sandstone, and shale (Ust-Urovsk suite); and (7) unconformably overlying Lower Carboniferous conglomerate. Preaccretion granitic rocks consist of early Paleozoic granodiorite and granite that intrude Upper Proterozoic and Cambrian stratified units, and large, probable Permian(?) granitic plutonic rocks that yield K-Ar ages of 180 to 220 Ma. Postaccretion units are a Lower Jurassic marine argillite that occurs in a narrow, fault-bounded trough, Middle and Late Jurassic intermediate volcanic and sedimentary rocks, Late Jurassic granitic rocks, and Early Cretaceous volcanic and sedimentary rocks (Shandorsk suite). Mesozoic units are interpreted as forming during tectonic escape between Siberian and North China cratons. **REFERENCES**: Kozlovsky, 1988; Zonenshain and others, 1990; Natal'in, 1993

AV **Alkatvaam terrane (accretionary wedge - predominantly turbidites) (Northeastern Koryak Highlands, Russian Northeast)**—Consists chiefly of an intensely-deformed, thick assemblage of clastic flysch, tuffaceous, and clastic deposits with local coeval intercalated Upper Triassic, Upper Jurassic, Cretaceous, and Paleocene island-arc volcanic and pyroclastic rocks. A basement composed of serpentinite melange contains fragments of late Paleozoic and Triassic ophiolite and metamorphic rocks. For paleomagnetic determinations, one grade C data point for Upper Cretaceous clastic sedimentary rocks yields a southerly displacement of $5^{\circ}\pm21^{\circ}$ with respect to the Siberian platform. **REFERENCES**: Pechersky, 1970; Aleksandrov, 1978; Pushcharovskiy and Til'man, 1982; Kazimirov, 1985; Grigor'yev and others, 1987

AY **Ayansk terrane (passive continental margin) (Northern part of Russian Southeast)**—Consists chiefly of Ordovician, Silurian, Devonian, and Upper Carboniferous, shallow-marine marine limestone, quartz sandstone, siltstone, diabase, conglomerate, breccia, dolomite, and argillite (Aldomsk, Lantarsk, Ulukansk, Tanchinsk, and Jikandisnsk suites). Also locally contains Lower and Upper Devonian, deep-marine tuffaceous rocks, and radiolarian chert, but relation with shallow-marine rocks is unclear. Paleozoic deposits are intruded by presumably late Paleozoic gabbro. Upper Ordovician, Silurian, and Middle and Upper Devonian limestone contains abundant brachiopods. Upper Carboniferous argillite contains Angara flora remnants. Upper Devonian diabase, conglomerate, and breccia may be rift-related. Paleozoic stratigraphic units are unconformably overlain by Upper Jurassic andesite and volcaniclastic rocks of Uda volcanic-plutonic belt (unit ud) which links Ayansk terrane to Siberian platform. **REFERENCES**: Krasny and others, 1966; Shilo, 1982; Zmievsky, 1990

BA **Baker terrane (accretionary wedge - predominantly oceanic rocks) (Southeastern part of U.S.A. Pacific Northwest)**—Consists chiefly of: (1) disrupted late Paleozoic and Triassic oceanic and island arc volcanic and plutonic rocks with deep-marine sedimentary rocks (Burnt River Schist, Mine Ridge Schist, Elkhorn Ridge Argillite, and Nelson Marble); and (2) mélange with serpentinite matrix and tectonic blocks. Tectonic blocks of igneous rocks within serpentinite mélange have oceanic (midocean ridge and seamount) and island arc affinities. Late Paleozoic and Triassic tectonic blocks of radiolarian chert and limestone are common. Paleozoic fusilinids contained in separate limestone blocks of both North American and Tethyan faunal provinces. The Lower Permian Canyon Mountain Complex and Burnt River Schist, which form large fragments in the melange, are interpreted as remnants of island arcs. The terrane is pervasively metamorphosed mostly to greenschist facies and locally amphibolite- and blueschist-facies assemblages. Postaccretion Late Jurassic to Early Cretaceous granitic plutons intrude and postdate the metamorphic fabric. Baker terrane previously interpreted as an accretionary wedge linked to the Blue Mountains island arc that had a long and complex history of volcanism and related tectonism. Baker terrane previously named an oceanic crust terrane (Vallier and others, 1977), a dismembered oceanic crust terrane (Brooks and Vallier, 1978), and a central mélange terrane (Dickinson and Thayer, 1978), before being called the Baker terrane (Silberling and others, 1984). **REFERENCES:** Vallier and others, 1977; Brooks and Vallier, 1978; Dickinson and Thayer, 1978; Silberling and others, 1984; Vallier, 1995

BD **Badzhal terrane (accretionary wedge - predominantly oceanic rocks) (Northern part of Russian Southeast)**—Previously published geological maps show widespread Carboniferous and Permian clastic rocks and limestone with macro- and microfauna, chert, mafic volcanic rocks, and Triassic and Jurassic clastic and rare volcanic units. Mesozoic units are present mainly in the eastern and southeastern part of the terrane. However, recent studies show that the southern part of the terrane consists of: (1) Paleozoic limestone olistoliths embedded in a clastic matrix; (2) chert inclusions that contain Permian and Triassic conodonts and Mesozoic radiolarians; (3) turbidite deposits with Late Triassic *Monotis* and *Holobia*, and Middle and Late Jurassic pelecypods and ammonites; (4) chert and siliceous shale with Late Triassic and Jurassic radiolaria and conodonts; and (5) small lenses of mafic volcanic rocks.

The terrane is interpreted as a Triassic to Middle Jurassic accretionary wedge complex that is composed of tectonically intermixed oceanic and continental slope deposits. Limestone units, which contain Carboniferous and Permian Tethyan fauna, are interpreted as the caps to seamounts. Mesozoic deposits in the southeastern part of the terrane may constitute a subterrane. A series of metamorphic domes with amphibolite-facies metamorphism occur near the boundary with the Turan terrane of the Bureya superterrane. The domes are interpreted as forming during formation of the accretionary complex.

Postaccretion rift-related Cenozoic alkalic basalt and sedimentary rocks of the Sakhalin-Primorye volcanic belt (unit sp) occur in narrow, north-striking basins within the terrane. The Badzhal terrane includes the Gorin terrane of A.I. Khanchuk (written commun., 1992). The Badzhal terrane, along with the Khabarovsk and Amur River terranes, are interpreted as tectonically linked to the Khingan-Okhotsk active continental margin to the south. The Cretaceous granitic and volcanic rocks of the Khingan-Okhotsk belt (unit ko) link together the Turan and Malokhingansk terranes of the Bureya superterrane, and the Badzhal, Galam and Ulban terranes. **REFERENCES**: Krasny, 1966, Romanchuk and Maiboroda, 1974; Shevelev and Kuzmin, 1990; Natal'in, 1991, 1993; Zablotsky and others, 1991

BE **Bennett terrane (passive continental margin) (Eastern Siberian Sea)**—Exposed on Bennett Island part of Eastern Siberian Sea and consists of Cambrian argillite with trilobites, and unconformably overlying graptolite-bearing Ordovician sandstone and siltstone. Weakly deformed. Younger overlap assemblages are Lower Cretaceous sandstone, siltstone, and coal that contain spores and pollen, and Cenozoic alkalic basalt and local tuff that contain interlayered siltstone with spores and pollen. Ar-Ar age of 1.2 Ma for basalt on Zhokhov Island. Bennett terrane is designated as a separate unit because it does not correlate with any of the subterranes of the Chukotka terrane. **REFERENCES:** Vol'nov and others, 1970; Vinogradov and others, 1977; Savostin and others, 1988; Fujita and Cook, 1990; Layer and others, in press

BL **Baladek terrane (cratonal) (Northern part of Russian Southeast)**—Consists chiefly of a crystalline basement complex and younger stratified units. Basement complex consists of anorthosite, gabbro-anorthosite, gabbro, gabbro-norite and pyroxenite (Malotokhikansk and Tokhikansk complexes). Anorthosite intruded by granite and granodiorite with preliminary U-Pb ages ranging between 2.2 and 2.6 Ga and K-Ar ages ranging between 964 and 365 Ma. Unconformably overlying stratified units are: (1) Lower Cambrian red conglomerate, sandstone, siltstone, basalt, and limestone (Shevlinsk and Usttimptonsk suites); (2) Upper Cambrian limestone, sandstone and siltstone; (3) thick units of sandstone, siltstone, conglomerate, limestone, and marl that contain Early Ordovician algae and yield K-Ar glauconite ages of 491 and 495 Ma.; (4) Mississippian sandstone: and (5) Triassic and Early to Middle Jurassic marine clastic rocks that are unconformably overlie older rocks and are interpreted as a forearc basin of the Uda volcanic-plutonic belt (Mongol-Okhotsk active continental margin) which occurs along the Stanovoy block of the North Asian craton. Unconformably overlapped by Late Jurassic marine clastic deposits and Early Cretaceous nonmarine clastic deposits (Uda-Zeya sedimentary basin) that links the Baladek terrane and the Siberian Platform. Early Cambrian archaeocyatheans of terrane are similar to those of Siberian Platform and differ from archaeocyatheans in limestone olistoliths in nearby Galam terrane. Baladek terrane bounded to south by Uligdansk dextral-slip fault and is interpreted as a fragment of the Siberian Platform. **REFERENCES**: Kirillova and Turbin, 1979; Karsakov and others, 1987; Belyayeva, 1988

BP **Broad Pass terrane (metamorphic) (Central Alaska Range, Alaska)**—Consists chiefly of a structural melange composed of chert, argillite, phyllite, bedded tuff, limestone, and flysch including graywacke, argillite, and chert-pebble and polymictic conglomerate. Chert contains Late Devonian(?) to Mississippian radiolarians, whereas limestone blocks contain Silurian and Devonian fossils (Jones and others, 1980). Poorly exposed and structurally complex. One of several miniterranes enclosed in highly-deformed flysch of the Kahiltna overlap assemblage. Broad Pass terrane interpreted as a structural melange of diverse metasedimentary rocks that formed during Cretaceous deformation of enclosing Kahiltna overlap assemblage. **REFERENCES**: Jones and others, 1982; Csejtey and others, 1986

BR **Bridge River terrane (accretionary wedge and subduction zone - predominantly oceanic rocks) (Southern Canadian Cordillera and northern U.S.A. Pacific Northwest)**—Consists chiefly of a highly disrupted assemblage of: (1) Mississippian to late Middle Jurassic (Callovian), and possibly Late Jurassic (Oxfordian) radiolarian chert, argillite and basalt; (2) subordinate siltstone and graywacke, alpine-type ultramafic and mafic intrusive rocks; (3) minor Upper Triassic olistostromal carbonate blocks; mainly of subgreenschist metamorphic facies, but in places greenschist and higher; and (4) local Triassic blueschist. Locally gradationally overlain by a generally fine-grained clastic sequence of volcaniclastic rocks, disrupted quartz-grain rich sandstone, and conglomerate with granitic clasts with Early Cretaceous fossils (Cayoosh assemblage of Mahoney and Journeay, 1993).

In the U.S.A. Pacific Northwest, the Bridge River terrane is interpreted herein to include the lithologically-similar Hozameen Complex which ranges in age from Late Triassic to Early Cretaceous(?) (C. Blome, written comm., 1989). The Hozomeen Complex is predominantly disrupted greenstone derived from pillow basalt and diabase with intercalations of metaclastic rocks, chert, and rare marble. The Bridge River may also be correlative with parts of the Chilliwack River terrane, including the Elbow Lake Formation, Orcas Chert, and Deadman Bay Volcanics in the northwest Cascades of the U.S.A. Pacific Northwest.

Lithologically similar but metamorphosed units composed of quartzite (metachert), amphibolite (metabasalt), and minor marble (Cogburn Group and Napeequa Schist) occur in the southeastern Coast Belt of the Canadian Cordillera and the Cascade Mountains, respectively, of the U.S.A. Pacific Northwest. Metamorphosed parts of the Cayoosh assemblage of the Bridge River terrane (Settler Schist of Monger, 1991a) are correlated with the Chiwaukum Schist of the Nason terrane (Evans and Berti, 1986). The younger part of the Bridge River terrane is correlated with the Easton terrane of the U.S.A. Pacific Northwest (Monger, 1991a).

The Bridge River terrane is interpreted to compose part of a Mesozoic accretionary complex similar to the Chugach terrane in southern and southeastern Alaska (Monger and others, 1994) which, in the Early Cretaceous, was trapped in the area eastward of the southward-displaced Gravina-Nutzotin-Gambier and the underlying Wrangellia superterrane. The Bridge River terrane and Wrangellia superterrane are overlain by Cretaceous (Albian-Cenomanian) sedimentary rocks. **REFERENCES**: Potter, 1983; Evans and Berti, 1986; Monger, 1989; Schiarizza and others, 1990, Monger, 1991a; Journeay and Northcote, 1992; Cordey and Schiarizz, 1992; Garver, 1992; Mahoney and Journeay, 1993; F. Cordey, written commun., 1994; Monger and others, 1994

BSC **Bering Sea collage (Northern Pacific Ocean and Bering Sea)**—Consists chiefly of a collage of passive and metamorphosed continental margin, island arc, oceanic crust, and convergent margin terranes. May include most of major terranes of western Alaska, including Goodnews, Koyukuk, Peninsular, Nixon Fork, Togiak, Ruby, and Seward terranes which are interpreted to extend westward offshore onto the continental shelf and upper slope. Boundaries of individual terranes cannot be determined with existing data.

Bureya superterrane (continental-margin arc) (Western part of Russian Southeast)—Subdivided into Malokhingansk and Turan terranes. Bureya superterrane interpreted as having been accreted to Sino-Korean craton during the Paleozoic. Subsequent Triassic to Early Jurassic translation occurred along North Asian craton margin, followed by Early and Middle Jurassic accretion of the Tukuringra-Dzhagdi terrane.

BUM **Malokhingansk terrane (Western part of Russian Southeast)**—Consists chiefly of an Archean metamorphic basement and younger

Proterozoic and early Paleozoic stratigraphic units. Metamorphic basement composed of two large units: (1) a Late Archean(?) lower unit (Amursk or Gudzhalsk suites) metamorphosed at amphibolite facies that is composed of gneiss, schist, marble, quartzite, and amphibolite; and (2) an Early Proterozoic stratigraphic unit (Soyuzninsk suite) metamorphosed at greenschist facies that is composed of marble, quartzite, and metasandstone. Overlain by Upper Proterozoic and Lower Cambrian that compose a continuous sequence of shale, siliceous schist, phyllite, and limestone (Ditursk, Iginchinsk, Murandavsk, Rudnosnsk, and Londokovsk suites). Upper Proterozoic and Cambrian sequence is intruded by granitic rocks (Birsk and Birobidzhansk complexes) that yield K-Ar ages of 604 and 301 Ma. Unconformably overlying, postaccretion units are Devonian, Permian, and Triassic shallow-marine clastic rocks (including Devonian limestone—Niransk, Pachansk, and Osakhtinsk suites). The clastic rocks were deposited in a narrow, fault-bounded belt along southeastern boundary of terrane, and contain abundant fauna that is similar to other zones of Central Asia. The Permian Osakhtinsk suites contain Kolyma Boreal pelcypods whereas the Permian deposits of the Badzhal and Khabarovsk terranes contain Tethyan fusulinids. Various Jurassic clastic units formed in individual basins that overlap the Malokhingansk and Turan terranes. The Cretaceous volcanic rocks of the Khingan-Okhotsk volcanic-plutonic belt (unit ko) overlap the Malokhingansk, Badzhal, Ulban and Nilan terranes. **REFERENCES**: Krasny, 1966, Kozlovsky, 1988, Martynyuk, 1983

BUT **Turan terrane (Western part of Russian Southeast)**—Consists chiefly of an Archean metamorphic basement and younger Proterozoic and early Paleozoic stratigraphic units. Metamorphic basement composed of two large units: (1) a lower unit (Amursk or Gudzhalsk suites) is composed of Late Archean(?) gneiss, schist, marble, quartzite, and amphibolite that is metamorphosed at amphibolite facies; and (2) an upper unit (Soyuzninsk suite) that is composed of Early Proterozoic marble, quartzite, and metasandstone that metamorphosed at greenschist facies. In the northwestern and southeastern parts of the terrane, near the boundary with the Nora-Sukhotinsk and Malokhingansk terranes, the gneiss and schist contain amphibolite and marble and are intruded by metamorphosed gabbro, pyroxenite, and peridotite. Younger overlap units are: (1) Proterozoic silicic and intermediate volcanic rocks, sandstone, and siltstone (Turansk suite); (2) Late Proterozoic limestone (Melgiysk suite) that contain plant microfossils and that occur in the central part of the terrane in the Melgiysk trough; (3) Cambrian clastic rocks and limestone (Allingsk and Chergelensk suites) that contain Archaeocyatheans; and (4) Middle and Late Devonian clastic rocks with marine faunas that are present as wall rocks in areas of abundant late Paleozoic and possibly early Mesozoic granitic rocks. Widespread Late Proterozoic and early Paleozoic granitic rocks (Kiviliysk and Sularinsk complexes) intrude the terrane. Granite clasts, possibly from these intrusives, are present in the Late Proterozoic clastic deposits. The granitic rocks consist of: (1) predominately biotite and hornblende-biotite granite, granodiorite, and diorite of the subduction-related Tyrma-Bureinsk complex; (2) minor Permian granosyenite, syenite, quartz syenite, and coeval volcanic rocks; and (3) large plutons of leucogranite and silicic volcanic rocks of possible Triassic age. The large Bureya sedimentary basin (unit bu) overlaps the eastern part of terrane. The narrow Umlekan-Ogodzhin belt (unit uo) overlies the northern flank of the terrane and sutures the Turan, Mamyn, Gonzha, and Oldoi terranes. The Cretaceous Khingan-Okhotsk volcanic-plutonic belt (unit ko) intrudes the southeastern part of the terrane. **REFERENCES**: Sigov, 1973; Kozlovsky, 1988, Zmiyevsky, 1979, 1980, Natal'in, 1991

CA **Cassiar terrane (cratonal margin terrane) (Eastern part of Canadian Cordillera)**—Located adjacent to North American craton margin (unit NAM). Consists of: (1) Proterozoic to Carboniferous deep- to shallow-marine shale, chert, turbiditic clastic rocks, sandstone, and carbonate; (2) Devonian to Carboniferous chert-bearing turbiditic clastic rocks and minor felsic volcanic rocks; (3) Mississippian to Late Triassic chert, shale, sandstone and carbonate rocks that are interpreted as continental margin deposits. Two representative stratigraphic columns provided for northern and central parts of terrane. Cassiar terrane is interpreted as a fragment of the North American cratonal margin displaced about 500 to 1000 kilometers northward during Late Cretaceous to early Tertiary dextral slip along the Tintina and Northern Rocky Mountain Trench faults. **REFERENCES:** Gabrielse, 1985; Wheeler and McFeely, 1991; Wheeler and others, 1991

CC **Cache Creek terrane (accretionary wedge and subduction zone - predominantly oceanic rocks) (Eastern part of Canadian Cordillera)**—Consists chiefly of partly disrupted, partly coherent, Lower Mississippian to Lower Jurassic (Pliensbachian) chert, pelite, basalt, alpine-type ultramafic rocks, and carbonate rocks. The carbonate rocks consist of distinctive large bodies of upper Paleozoic or Triassic reefoidal rocks that at least locally overlie volcanic rocks. The Upper Triassic volcaniclastic rocks are locally of probable arc origin, and in one locality, associated pelitic rocks are possibly as young as Middle Jurassic (Monger, 1977; Cordey and others, 1987). Various subterranes are distinguished by different stratigraphies or lithologic associations. Two variants are depicted in stratigraphic columns for the northern and southern parts of the terrane. In places the terrane consists of melange composed of blocks of basalt, limestone, chert, gabbro, and ultramafic rocks in a chert-argillite matrix. In other places, however, the terrane locally displays coherent stratigraphy. Late Triassic blueschist (210-217 Ma) occurs in central British Columbia at about latitude 55° N (Paterson and Harakal, 1974).

Within the melange units, carbonate tectonic blocks contain Late Permian fusulinid, coral, and conodont faunas that are similar to coeval units in the Russian Southeast and to the Permian Tethys region. These are the only truly "exotic" faunas yet recognized in the Canadian Cordillera (Ross and Ross, 1983; Carter and others, 1991). In southern British Columbia, the Marble Canyon carbonate contains juxtaposed latest Permian (late Dzhulfian to Chanxingian) and earliest Triassic (Griesbachian) conodonts (Beyers and Orchard, 1991). Recognition of these two faunas in one rock body is unique in western North America. Comparable coeval faunas occur together only in south China, Tibet, and Armenia (Tozer, 1988), all regions with Permian Tethyan faunas.

The southern Cache Creek terrane is interpreted as an accretionary wedge and subduction zone complex that was tectonically linked to the west-facing early Mesozoic Nicola-Rossland arc (Monger, 1985; Mortimer, 1987; Parrish and Monger, 1992) of the Quesnellia terrane. After arc formation, the Cache Creek terrane was thrust eastward over the Quesnellia terrane probably in the Late Jurassic at about 160 Ma (Travers, 1978). In contrast, the northern Cache Creek terrane was thrust southwestward on the King Salmon Fault over the Stikinia terrane in the Middle Jurassic (Bajocian).

The Upper Jurassic sedimentary rocks of the Bowser Basin lie depositionally upon Stikinia and are derived largely from the Cache Creek terrane (Gabrielse, 1991). Nelson and Mihalynuk (1993) recently proposed that the Cache Creek terrane was enclosed in the Early Jurassic by counterclockwise, southward rotation of the Stikinia and Yukon-Tanana terranes. For paleomagnetic determinations, data have been obtained from the 125 Ma Axelgold anorthositic intrusive. Although the paleomagnetic data themselves are of high quality, a question exists about the attitude of the ancient horizontal. As a result, the data are assigned to grade B and indicate a $15^{\circ} \pm 7^{\circ}$ southerly displacement with respect to North America. **REFERENCES:** Paterson and Harakal, 1974; Monger, 1977; Travers, 1978; Monger and Irving, 1980; Ross and Ross, 1983; Monger, 1985; Cordey and others, 1987; Mortimer, 1987; Tozer, 1988; Beyers and Orchard, 1991; Carter and others, 1991; Gabrielse, 1991; Parrish and Monger, 1992; Nelson and Mihalynuk, 1993

CD **Cadwallader terrane (island arc) (Southern part of Canadian Cordillera)**—Major units are: (1) oceanic arc tholeiite (Pioneer Greenstone), diorite, trondhjemite, gabbro, and alpine-type ultramafic rocks of Permian age; (2) probably overlying Late Triassic arc-volcanic rocks, carbonate, and distinctive carbonate-volcanic-plutonic clast conglomerate (Hurley Formation of Cadwallader Group and Tyaughton Group); (3) Lower and Middle Jurassic fine grained, nonvolcaniclastic rocks (Last Creek Formation) (Rusmore, 1987; Leitch and others, 1991; Cordey and Schiarizza, 1993); and (4) possibly overlying Jurassic and Cretaceous Relay Mountain Group, and possibly the Cayoosh assemblage. The latter two units are structurally interleaved along early Late Cretaceous thrust faults (Journeay and Northcote, 1992). The Cadwallader terrane is interpreted as a Permian and Triassic island arc and younger strata. Based on similar stratigraphy and relations to other terranes, the Cadwallader terrane is correlated with the Wallowa terrane in the U.S.A Pacific Northwest (Follo, 1992). **REFERENCES:** Rusmore, 1987; Leitch and others, 1991; Follo, 1992; Garver, 1992; Cordey and Schiarizza, 1993; Monger and others, in press

CE **Chelan Mountains terrane (oceanic crust) (North-central part of U.S.A. Pacific Northwest)**—Consists chiefly of two main units: (1) an oceanic assemblage composed of fine-grained hornblende schist, amphibolite, mica-quartz schist (metachert), hornblende-biotite schist, and locally abundant, scattered metaultramafic rocks, and scattered marble (pre-Triassic(?) Napeequa Schist); and (2) the Cascade River unit that is composed of various arc-derived rocks that are locally intensely folded and consist mainly of metaconglomerate and metavolcanic rocks (Tabor and others, 1989). Included in the Chelan Mountains terrane is the Late Triassic Marblemount belt of metaplutonic rocks that unconformably underlies the Cascade River unit. The Late Triassic age of metavolcanic rocks in the

Cascade River unit suggests that the volcanic and plutonic rocks of the Cascade River unit were coeval parts of the Marblemount metaplutonic belt (Tabor and others, 1988). The Chelan Mountains terrane is thrust over the Swakane terrane. In the Chelan Mountains terrane, the Cascade River unit may correlate with the Cadwallader terrane, and the Napeequa Schist may correlate with the Bridge River terrane. **REFERENCE:** Tabor and others, 1989

Chugach terrane (accretionary wedge and subduction zone - both oceanic rocks and turbidites) (Southern and southeastern Alaska)—Present in a broad curvilinear trend. Forms a large composite terrane between the Border Ranges and Contact faults. Consists of three major units: (1) a northern unit of blueschist and greenschist; (2) a central unit of the McHugh Complex and correlative units; and (3) a southern unit of the Valdez Group and correlative units. The terrane constitutes a long-lived Mesozoic subduction zone and accretionary wedge complex formed along the southern margin of Alaska.

Blueschist and greenschist (subduction zone, predominantly oceanic rocks)—Consists chiefly of blueschist and interlayered greenschist derived mainly from shale, chert, and basaltic tuff. Named portions of unit are the schists of Liberty Creek, Iceberg Lake, Seldovia, and Raspberry Strait. Unit too small to depict on map and occurs in various narrow, intensely-deformed, fault-bounded lenses mainly along the northern or inboard margin of McHugh Complex and correlative units. Metamorphic grade varies from blueschist to transitional greenschist-blueschist facies. U-Pb sphene, Ar-Ar, and Rb-Sr mineral isochron indicate mainly Early Jurassic metamorphic ages. Blueschist and greenschist unit interpreted as discontinuous remnants of a high-pressure and low-temperature subduction zone assemblage that was tectonically linked to early Jurassic Talkeetna arc to the north.

CGM **McHugh Complex and correlative units (subduction zone, predominantly oceanic rocks) (Southern and southeastern Alaska)**—Composed chiefly of mainly Upper Triassic, Jurassic, and Lower to mid-Cretaceous argillite, basalt, graywacke, radiolarian chert, and limestone, with sparse conglomerate, pillow basalt, mafic tuff, volcanic rocks, and plutonic rocks, and with exotic blocks of ultramafic rocks and limestone. Named portions of unit are the McHugh and Uyak Complexes, Kelp Bay Group, and unnamed chert and basalt of Kachemak Bay previously interpreted as the Kachemak terrane by Jones and others (1987). Some exotic limestone blocks contain Permian Tethyan fusulinids. The McHugh Complex contains prehnite-pumpellyite to lower greenschist facies metamorphic assemblages. The McHugh Complex and correlative units intruded by mid-Cretaceous trondhjemite and by early and middle Tertiary granitic plutonic rocks in outcrops that are too small to depict on map. The McHugh Complex and correlative units are interpreted as a Mesozoic subduction zone melange that is composed of tectonically-disrupted oceanic crust, seamount, and trench-fill assemblages. Subduction is linked to the Early and Middle Jurassic Talkeetna arc, and to the Late Jurassic and Early Cretaceous Chitina and Chisana arcs to north.

CGV **Valdez Group and correlative units (accretionary wedge - predominantly turbidites) (Southern and southeastern Alaska)**—Composed chiefly of Late Cretaceous (Campanian to Maastrichtian) flysch, mainly graywacke. Named portions of the unit are the Valdez Group, Kodiak and Shumagin Formations, Sitka Graywacke. Unit contains sparse megafossils. A thick metabasalt sequence occurs local along the southern margin. The unit generally exhibits lower greenschist facies metamorphism and is complexly folded and faulted. Metamorphic grade increases to upper amphibolite facies in the informally named Chugach metamorphic complex of Hudson and Plafker (1982) in eastern Chugach Mountains. In this area, granitic intrusive rocks of the Sanak-Baranof plutonic belt (50-65 Ma) (unit sf), and associated aureoles of amphibolite-facies metamorphism link the Chugach terrane to the adjacent northern Prince William terrane by early Eocene. Elsewhere, early Tertiary plutons are locally truncated by Contact fault that occurs between the Chugach and Prince William terranes. The Valdez Group and correlative units are bounded to the north by the Border Ranges fault and the Wrangellia superterrane, and bounded to the south and west by the Contact fault and the Prince William terrane. The Valdez Group and correlative units are interpreted as an accretionary wedge complex composed of trench deposits derived from a Cretaceous magmatic arc to the north and east (present-day coordinates), and partly as an intraoceanic accreted primitive arc. **REFERENCES**: Connelly, 1978; Connelly and Moore, 1979; Decker and others, 1980; Hudson and Plafker, 1982; Johnson and Karl, 1985; Brew and others, 1988; Roeske and others, 1989; Plafker and others, 1989b; Sisson and others, 1989; Karl and others, 1990; Lull and Plafker, 1990; Bradley and Kusky, 1992; Nelson, 1992

CH **Chulitna terrane (ophiolite) (Central Alaska Range, Alaska)**—Consists chiefly of four major units: (1) Late Devonian ophiolite composed of serpentinite, gabbro, pillow basalt, and Mississippian chert; (2) Permian volcanic conglomerate, limestone, chert, and argillite; (3) Lower Triassic limestone; (4) Upper Triassic redbeds, including red sandstone, siltstone, argillite, and conglomerate, and pillow basalt, limestone, sandstone, and shale; and (5) Jurassic argillite, sandstone, and chert. A continuous stratigraphic sequence can be reconstructed from relic depositional contacts and (or) reworked clastic detritus from underlying rocks. Ammonites from Lower Triassic limestone show strong affinities with faunas from California, Nevada, and Idaho, but differ from assemblages in Canada. The terrane is moderately to intensely folded and thrust-faulted and structurally overlies highly deformed late Mesozoic argillite and graywacke of the Kahiltna overlap assemblage to west. Chulitna terrane interpreted as an allochthonous fragment of an ophiolite and overlying igneous arc and sedimentary sequence. **REFERENCES**: Nichols and Silberling, 1979; Jones and others, 1980, 1982; Csejtey and others, 1986

Chukotka terrane (passive continental margin) (Northern part of Russian Northeast)—Consists chiefly of Anyui, Chauna, and Wrangell passive continental margin subterranes. Locally extensively overlain by Jurassic and Early Cretaceous sedimentary rocks of Raucha Basin (unit rc), and by Cretaceous and early Paleocene volcanic rocks of Okhotsk-Chukotka volcanic plutonic belt (unit oc). Correlated with Arctic Alaska superterrane to east. Together the Chukotka terrane and Arctic Alaska superterrane constitute a long-lived Paleozoic and early Mesozoic continental margin.

CHA **Anyui subterrane (passive continental margin) (Northern part of Russian Northeast)**—Consists chiefly of: (1) a widely prevalent, thick sequence of Lower Triassic chlorite-quartz slate and mafic tuff that grades upward into fine-grained graywacke with local diabase sills and dikes, and pelecypods and ammonites; (2) Middle(?) and Upper Triassic (Carnian-Early Norian) interbedded carbonaceous slate, siltstone and fine-grained sandstone; (3) Middle and upper Norian slate with subordinate siltstone and sandstone; and (4) Lower Jurassic (Hettangian-Sinemurian) shale and siltstone. General structure consists of areas of tightly compressed folds and thrusts that alternate with areas of more gentle and open linear and doubly-plunging folds that are south-verging in the south and north-verging in the north. In the northern part of the subterrane (Alyarmaut Uplift) are mainly biotite-quartz, biotite-plagioclase-quartz, biotite-amphibole-pyroxene, mica schist with garnet, staurolite, andalusite and cordierite, and marble and calc-schist with Lower Carboniferous corals and brachyopods. The metamorphic rocks occur in domes surrounded by concentric and isoclinal folds and are separated by thrust faults from the younger Triassic units. **REFERENCES**: Drabkin, 1970; Ansberg and Safronov, 1972; Til'man, 1973; Bychkov, 1991

CHC **Chauna subterrane (passive continental margin) (Northern part of Russian Northeast)**—Consists chiefly of: (1) chlorite-quartz and sericite-chlorite schist, phyllite and metasandstone including Ordovician granite with a Rb-Sr isochron age of 439±32 Ma; (2) Lower and Middle Devonian subarkose and quartz sandstone, slate, fine-grained, organogenic limestone that contain various benthic fauna and sometimes fish armor and psilophyte remnants; (3) Upper Devonian subarkose and arkose sandstone, subordinate slate, and limestone with foraminifers; (4) unconformably overlying Lower and Middle Carboniferous arkose, sandstone, and conglomerate with granite and quartzite boulders, slate, calcareous sandstone, and limestone with corals, brachyopods, and foraminifera; (5) local Upper Carboniferous-Permian carbonaceous slate and sandstone with fossil flora; (6) Lower Triassic graywacke and slate; and (7) middle and upper Norian sandstone, conglomerate, and argillaceous limestone with abundant *Monotis*. The Lower Triassic graywacke and slate contain a Carnian and Norian fauna and lie transgressively on the older Paleozoic units. Both the Paleozoic and Triassic units are folded and thrusted toward the north. Numerous diabase and gabbro-diabase folded sills intrude the terrane. The Paleozoic units are interpreted as continental shelf deposits, and the Triassic units are interpreted as a turbidites. **REFERENCES**: Gorodinskiy, 1963; Rozogov and Vasil'eva, 1968; Drabkin, 1970; Til'man, 1973; Tibilov and others, 1986; Kos'ko and others, 1970; Bychkov, 1991

CHW **Wrangel subterrane (passive continental margin) (Wrangel Island)** Consists chiefly of following units. (1) Upper Proterozoic clastic and metavolcanic rocks that contain small bodies of schistose metadiabase, metagabbro, and granite. Unit yields a U-Pb zircon age of 633 Ma for metavolcanic rocks, and 699 Ma for a porphyritic granite sill. Unit metamorphosed to greenschist and epidote-amphibolite facies. (2) Upper Silurian and Lower Devonian conglomerate, arkose, subarkose, rare phyllite, shale, quartz siltstone and sandstone with brachyopods, pelecypods, bryozoans, and corals. (3) Upper Devonian and Lower Carboniferous conglomerate, quartz, sandstone, variegated marl, and dolomite with gypsum lenses. (4) Widespread Lower and Middle Carboniferous biohermal, crinoidoidal, and argillaceous limestone, sandstone, siltstone, and shale that contain brachyopods, corals, bryozoans, goniatites, and foraminifers. (5) Permian argillite and bioclastic limestone transgressively overlie the Carboniferous units and contain Kolyma pelecypods and foraminiferas. And (6) Triassic sandstone, siltstone, shale, turbidites, and phosphate and argillaceous concretions that contain Norian *Monotis*. The terrane is deformed into a series of tectonic sheets that are separated by north-verging thrust faults. **REFERENCES**: Kameneva, 1975; Solov'yeva, 1975; Fujita and Cook, 1990; Kos'ko and others, 1990; Cecile and others, 1991; Kos'ko and others, 1993

CK **Chilliwack River terrane (island arc) (Southern British Columbia, Canadian Cordillera and northern U.S.A. Pacific Northwest)**—In the Canadian Cordillera, consists mainly of Devonian to Permian volcanic-arc rocks, clastic rocks, and limestone (Chilliwack Group) that are stratigraphically overlain by Upper Triassic and Lower Jurassic arc-related, mainly fine-grained, clastic rocks (Cultus Formation) and rare Late Jurassic pelitic rocks that are internally imbricated along mid- to Upper Cretaceous thrust faults (Monger, 1977, 1989). Lower Permian fossils in the Chilliwack Group are most like those of the Quesnellia and Stikinia terranes. The Chilliwack River terrane in Canada includes the Vedder Complex (too small to depict on map) composed of gneissic amphibolite with local blueschist. The complexes contains blocks of melange with chert that contains probable Callovian and Tithonian radiolarians (F. Cordey, written comm., 1991).

In the U.S.A. Pacific Northwest, the Chilliwack River terrane consists of the Chilliwack Group (Daly, 1912; Cairnes, 1944), the Elbow Lake Formation (Brown and others, 1987), the Yellow Aster Complex (Misch, 1966), and the Vedder Complex (Armstrong and others, 1983). The Elbow Lake Formation is a melange that contains mostly Mesozoic metaclastic rocks and distinctive Triassic radiolarian ribbon chert, and Ti-rich basalt (Brown and others, 1987). The melange encloses or is associated with a variety of exotic blocks including possible Precambrian gneiss, early Paleozoic intrusive rocks, ultramafic rocks of the Yellow Aster complex, and the late Paleozoic Na-amphibole schist that locally forms part of the Vedder Complex (Tabor and others, 1989). Also included in the Chilliwack River terrane are the East Sound Group (Brandon and others, 1989), the Orcas Chert and Deadman Bay Volcanics, the Garrison Schist, and the Turtleback Complex (Brandon, 1989; Brown and Vance, 1987). In the mid-Cretaceous, the Chilliwack River terrane was thrust over the Nooksack Group of the Harrison Lake terrane and overthrust by the Easton terrane (Misch, 1966; Brown, 1987). For paleomagnetic determinations, the postaccretion Mount Barr (18 Ma) and Hope (38 Ma) plutons, that intrude both the Chilliwack and Bridge River terranes, both yield good paleomagnetic data. However, with little control over the attitude of the ancient horizontal, the data are assigned to grade C, and indicate displacements near zero ($-13^{o}\pm11^{o}$ northward, and $1^{o}\pm5^{o}$ southward respectively) with respect to North America. **REFERENCES**: Daly, 1912; Cairnes, 1944; Misch, 1966; Symons, 1973b; Brown, 1987; Brown and Vance, 1987; Brown and others, 1987; Brandon and others, 1989; Tabor and others, 1989

CKC **Chukchi Cap terrane (passive continental margin) (age unknown) (Beaufort Sea, Chukchi Sea, and adjacent area)**—Bathymetry suggests that the extensive high-standing, flat-topped, steep-sided Chukchi Cap and the adjacent Chukchi Spur, which connects the cap with the Chukchi Shelf, are displaced fragments of continental crust. The seafloor on the cap extends to within 279 m of sea level. Total-intensity magnetic data indicate that the western and northern flanks of the Chukchi Cap are marked by a large positive magnetic anomaly that resembles the anomaly which occurs along the continental margin of east coast of the United States. The anomaly suggests that the Chukchi Cap terrane consists of continental rocks. **REFERENCES:** Hunkins and others, 1962; Shaver and Hunkins, 1964

CO **Coldfoot terrane (metamorphosed continental margin) (Southern Brooks Range, Alaska)**—Consists chiefly of two major units: (1) a structurally high sequence of quartz-mica schist, quartzite with detrital zircons as young as 360-370 Ma, mica schist, and minor metamorphosed felsic and mafic volcanic rocks; (2) a structurally intermediate sequence of calc-schist and marble that contain rare stromatolites and Devonian conodonts; and (3) a structurally low sequence of quartz-mica schist, quartzite, pelitic schist, and calcareous schist. Locally present in the central and western Brooks Range is the Devonian Ambler sequence that consists of metamorphosed rhyolite and basalt volcanic flows, tuff, and breccia with stratiform massive sulfide deposits. The metavolcanic rocks are interlayered with quartz-mica schist, marble, calcschist, and graphitic schist. The terrane contains local metagabbro and metadiabase dikes and sills of middle Paleozoic(?) age. In the central Brooks Range, the calcschist and marble unit is exposed in local structural windows beneath the quartz-mica schist unit. The terrane is locally intruded by metamorphosed Devonian and Late Proterozoic granitic plutons. The terrane is informally called the *schist belt*.

Polymetamorphosed and deformed in the late Jurassic and Cretaceous. The terrane exhibits relict regional Mesozoic blueschist-facies mineral assemblages overprinted by pervasive lower to middle greenschist-facies mineral assemblages. The terrane also contains local areas of Late Proterozoic(?) amphibolite-facies minerals. The terrane displays locally intense retrogressive metamorphism and deformation and formation of phyllonite adjacent to structurally overlying Angayucham terrane. Coldfoot terrane structurally underlies Hammond terrane to north and is structurally overlain by Angayucham terrane to south. Coldfoot terrane correlated with Seward terrane to southwest. Although assigned by other workers to the Arctic Alaska superterrane, the Coldfoot terrane is herein designated as a separate terrane because of possessing a unique stratigraphic, structural, and metamorphic history. The Coldfoot terrane is interpreted as an intensely metamorphosed and deformed, displaced fragment of the North American continental margin. **REFERENCES**: Armstrong and others, 1986; Hitzman and others, 1982; Till and others, 1988; Dillon, 1989; Karl and others, 1989; Moore and Mull, 1989; Gottschalk, 1990; Karl and Aleinikoff, 1990; Moore and others, 1992; Patton and others, 1992

CW **Clearwater terrane (island arc) (Central Alaska Range, Alaska)**—Consists chiefly of a structurally complex assemblage of argillite, greenstone (pillow basalt), marble derived from shallow-marine limestone, and metarhyolite. Marble contains Late Triassic (late Norian) fossils. Contains fault-bounded pluton of Cretaceous(?) granodiorite. Weakly metamorphosed and penetratively deformed at lower greenschist facies. The terrane occurs as a narrow fault-bounded lens along Broxson Gulch thrust between the Maclaren terrane to the north and the Wrangellia superterrane to the south. Because of the assemblage of basalt and rhyolite volcanic rocks and shallow-marine sedimentary rocks, Clearwater terrane interpreted as a shallow-level fragment of an island arc. **REFERENCES**: Nokleberg and others, 1985, 1989a, 1992; Csejtey and others, 1986

CZ **Crazy Mountains terrane (passive continental margin) (East-central Alaska)**—Consists chiefly of two major sequences: (1) maroon and green slate, grit, and black limestone with floating quartz grains with the trace fossil *Oldhamia* of probable Cambrian age in slate; and (2) younger sequence of Lower Devonian or older mafic volcanic rocks, agglomerate, chert, and clastic rocks, fossiliferous Lower to Middle Devonian limestone, and Upper Devonian chert-pebble conglomerate. Crazy Mountains terrane occurs in two displaced fragments and is interpreted as displaced parts of the early Paleozoic continental margin of North America. **REFERENCES**: Churkin and others, 1982; Dover, 1990

DL **Dillinger terrane (passive continental margin) (West-central Alaska)**—Occurs as a major unit south of the Denali fault and in a smaller fragment along branches of the fault. Within branches of the fault, the Dillinger terrane consists of: (1) Cambrian and Ordovician basinal limestone, banded mudstone, and silty limestone turbidite deposits; and (2) Upper Silurian through Middle Devonian, unnamed, shallow-marine limestone and dolomite. The terrane unconformably overlain by sedimentary rocks of the Cretaceous Kuskokwim Group (unit kw). South of Denali fault, terrane consists chiefly of: (1) Cambrian(?) to Ordovician calcareous turbidites, shale, and minor greenstone; (2) Lower Ordovician to Lower Silurian graptolitic black shale and chert; (3) Lower to Middle Silurian laminated limestone and graptolitic black shale; (4) Middle to Upper Silurian sandstone turbidite deposits and shale; and (5) Upper Silurian to Lower Devonian limestone, breccia, sandstone, and shale. Various parts of the terrane are dextrally offset along Denali fault in southwestern Alaska Range, are locally structurally, and are possibly stratigraphically overlain by the Mystic terrane. Dillinger terrane complexly folded and faulted, and interpreted as early to middle Paleozoic basinal deposits that are correlated with the early and middle Paleozoic rocks of the Nixon Fork terrane. The Dillinger terrane is assigned by Decker and others (1994), along with the Minchumina, Mystic, and Nixon Fork terranes, to the composite Farewell terrane. The Dillinger terrane is interpreted as a displaced fragment of the Paleozoic and early Mesozoic continental margin of North America. Stratigraphic column refers to area within branches of Denali fault. **REFERENCES**: Jones and others, 1982; Bundtzen and Gilbert, 1983; Gilbert and Bundtzen, 1984; Blodgett and Clough, 1985; Decker and others, 1994

DY **Dorsey terrane (passive continental margin) (East-central part of Canadian Cordillera)**—Consists chiefly of three members in its type area: (1) a lower member composed of fine grained quartzite, slate, ribbon chert and discontinuous bands of limestone, cherty limestone and dolostone; (2) a middle member composed of Lower Pennsylvanian, thick-bedded, cherty limestone (about 300 m thick); and (3) an upper member composed of a lower unit of conglomerate, grit, quartz sandstone and argillite (about 300 m thick) that is overlain by argillite, slate, ribbon chert and minor limestone (about 500 m thick). Dorsey terrane overlies volcanic rocks, presumably of the Slide Mountain(?) terrane, but relations between the two are unknown. Recent work suggests that parts of the Dorsey terrane may correlate with parts of the Cassiar terrane. **REFERENCES:** Monger and others, 1991; Gordey, 1994

EA **Easton terrane (accretionary wedge and subduction zone - predominantly oceanic rocks) (Southeastern Canadian Cordillera and northwestern U.S.A. Pacific Northwest)**—Consists chiefly of the Middle Jurassic Easton Metamorphic Complex that consists of the Shuksan Greenschist which is derived from MORB-like basaltic rocks, and the overlying Middle Jurassic Darrington Phyllite which consists mostly of pelitic metaclastic rocks (Misch, 1988 Brown, 1986). Exhibits Cretaceous blueschist-facies metamorphism that distinguishes the Easton terrane from other regionally imbricated late Paleozoic and Mesozoic terranes. The Easton terrane is correlated with Bridge River terrane to north in southern Canadian Cordillera by Monger and others (1991, 1994). Both are interpreted, along with many components of the North Cascades, as part of a large accretionary wedge and subduction zone complex. On the index map of onshore terranes and overlap assemblages (Map A, Sheet 4), the Easton terrane is combined with the Bridge River terrane (unit BR). **REFERENCES:** Armstrong and others, 1983; Monger; 1991a; Monger and others, 1994

EK **Ekonay terrane (accretionary wedge and subduction zone - predominantly oceanic rocks) (Eastern Koryak Highlands, Northeastern Russian Northeast)**—Consists chiefly of three main units: (1) serpentinized ultramafic rocks, layered gabbro, and ultramafic rock complex; (2) leucocratic gabbro, gabbro-diabase, diabase, and plagiogranite; and (3) upper Paleozoic to Triassic volcanic-sedimentary assemblage (spilite, basalt and rarely andesite and plagiorhyolite; various tuff, cherty, biogenic, tuffaceous and clastic rocks; subordinate carbonate and clastic rocks, argillite, volcaniclastic siltstone and sandstone). The volcanic-sedimentary assemblage includes tectonic fragments of Carboniferous to Triassic units that contain Tethyan foraminifers, radiolarians, and conodonts.

The terrane is unconformably overlain by the Upper Jurassic to Cretaceous (up to Santonian) Nakypyilyak Complex that is composed of shallow-marine mudstone, argillite, volcanogenic and polymictic sandstone, grit, conglomerate with subordinate intermediate to felsic tuff, bioclastic limestone, coquina, and local extensive olistostrome deposits. The complex locally contains abundant Upper Jurassic and Lower Cretaceous pelecypods and ammonites. Unconformably overlying the complex are Campanian and Maastrichtian conglomerate, grit, sandstone, siltstone, argillite and tuff. The Upper Jurassic and Lower Cretaceous sedimentary and volcanic rocks are interpreted as the frontal part of a volcanic arc.

For paleomagnetic determinations, grade A data were obtained from a reconnaissance study. Southerly displacements (with repect to the Siberian platform) are greatest for Upper Triassic sedimentary rocks from the Ekonay terrane ($39^{o}\pm14^{o}$), and are shallow ($2^{o}\pm36^{o}$) for postaccretion Cretaceous turbidite deposits. Samples from basalt flows and dikes of the Ryelyavaamski ophiolite of Upper Jurassic and Lower Cretaceous age are also displaced to the south ($35^{o}\pm13^{o}$). The Ekonay terrane occurs in a folded thrust sheet that is tectonically overlain by the Yanranay terrane. The Ekonay terrane is interpreted as a subduction zone assemblage that was tectonically paired to the Okhotsk-Chukotka volcanic-plutonic belt (unit OC). **REFERENCES**: Aleksandrov, 1978; Volobueva and Krasnyi, 1979; Pushcharovskiy and Til'man, 1982; Ruzhentsev and others, 1982; Pewe, 1984; Byalobzhesky and others, 1986; Grigor'yev and others, 1987; Gel'man and others, 1988; Bychkov and others, 1990; Sokolov, 1990; Bragin, 1991; Didenko and others, 1993

GD **Goodnews terrane (subduction zone - predominantly oceanic rocks) (Southwestern Alaska)**—Consists chiefly of a disrupted assemblage of pillow basalt, diabase, gabbro, chert, argillite, minor limestone, volcanogenic sandstone, and ultramafic rocks. Limestones contain Ordovician, Devonian, Mississippian, Permian, and Triassic fossils whereas cherts contain Mississippian, Triassic, and Jurassic fossils. The terrane displays prehnite-pumpellyite, greenschist, and blueschist metamorphic mineral assemblages. Blueschist-facies minerals occur in two geographically separated belts. South of Goodnews Bay, the terrane yields a Late Triassic K-Ar blue amphibole age and is intruded by pre-186 Ma diorite and gabbro plutons. Near the Kilbuck terrane, the northern part of the Goodnews terrane contains a greenschist facies unit that yields a Late Jurassic K-Ar amphibole age. The Goodnews terrane is unconformably overlain by Lower Cretaceous marine sandstone and conglomerate derived from the Kilbuck and Togiak terranes, and by Cretaceous sedimentary rocks of the Kuskokwim Group (unit kw). The Goodnews terrane is intruded by Late Cretaceous and early Tertiary plutonic rocks of the Kuskokwim Mountains sedimentary, volcanic, and plutonic belt. The Goodnews terrane is interpreted as a subduction zone complex that was tectonically paired to the Togiak island arc terrane. **REFERENCES**: Hoare and Coonrad, 1978; Murphy, 1987; Box, 1985b, c; Box and others, 1993; Dusel-Bacon and others, 1992; Patton and others, 1992

Galam **terrane (accretionary wedge - predominantly oceanic rocks) (Northern part of Russian Southeast)**—Consists chiefly of poorly studied Paleozoic deposits that are interpreted to occur in three subterranes: (1) Galam River subterrane (GLG); (2) Tugur subterrane (GLT); and (3) Nilan subterrane (GLN). The Galam River subterrane is separated from the Baladek subterrane to the northwest by the Uligdan dextral-slip fault. The Galam subterrane is bounded by the Tugur subterrane to the southeast. Most of the Galam terrane is overlain by the Jurassic and Lower Cretaceous overlap assemblage deposits of the Torom sedimentary basin (unit to). The Galam terrane is interpreted as tectonically linked to the Uda volcanic-plutonic belt (unit ud) (Mongol-Okhotsk active continental margin) that formed along the Stanovoy block of the North Asian Craton (unit NSS).

GLG **Galam River subterrane (accretionary wedge - predominantly oceanic rocks) (Northern part of Russian Southeast)**— Consists chiefly of Cambrian to Permian sedimentary rocks that consist of: (1) Cambrian and Lower Ordovician limestone that contain archaeocyathids, trilobites, inarticulate brachiopods, and algae; limestone occurs in olistoliths in a flysch matrix; and (2) Silurian to Lower Carboniferous and Upper Permian turbidite deposits, and lesser mafic volcanic rocks, chert, siliceous shale, pelagic shale, and fine-grained graywacke that are included in widespread olistostrome deposits. Anorthosite and granitic rocks, similar to the Baladeksk terrane, are also present in olistoliths. Oceanic chert, mafic volcanic rocks, and clastic rocks of Silurian to Late Permian age are also present in local tectonic slices. Chert contains poorly preserved post-Early Devonian radiolarian. The Carboniferous and Permian floras belong to the Angara physiographic province. Along the boundary with Baladeksk terrane are fault slices of harzburgite, dunite, and websterite that are interleaved with Silurian deposits. **REFERENCES**: Kirillova and Makhinin, 1983, Roganov and others ,1986, Natal'in and Popeko, 1991

GLN **Nilan subterrane (accretionary · wedge - predominantly oceanic rocks) (Northern part of Russian Southeast)**—Consists chiefly of Devonian to Permian sedimentary rocks that consist of an older assemblage of: (1) Lower to Middle Devonian shale and graywacke (Sivaksk suite), that contain crinoids, brachiopods, and bryozoans: and (2) Lower Carboniferous shale and graywacke with brachiopod, crinoids, and bryozoans. The Devonian to Early Carboniferous units are interpreted as tectonic slices of continental-slope sedimentary rocks that are interleaved with oceanic crust. The younger assemblages comprising the Nilan subterrane consist of: (1) thick, barren sequences of Middle to Upper Carboniferous flysch, mainly shale and graywacke (Ekimchansk suite) that contain a sparse, poorly preserved flora; and (2) siliceous shale, siltstone, sandstone, spilite, and limestone with Lower Permian fusulinids. Within the Nilan subterrane are a series of metamorphic domes that contain greenschist and epidote-amphibolite facies metamorphic rocks with protoliths that are compositionally similar to the above units. **REFERENCES**: Kozlovsky, 1988, Sidorov, 1990

GLT **Tugur subterrane (accretionary wedge - predominantly oceanic rocks) (Northern part of Russian Southeast)**—Consists chiefly of Cambrian to Permian sedimentary rocks that consists of: (1) olistoliths composed of Cambrian, and Middle Devonian to Lower Permian limestone that contain archaeocyatheans, trilobites, inarticulate brachiopods, corals, brozoans, and algae; (2) Middle Devonian olistostromes composed of limestone with Cambrian archaeocyatheans and trilobites, and olistoliths of granitic rocks; and (3) widespread Lower Carboniferous and Upper Permian turbidite deposits and olistostromes that contain lesser mafic volcanic rocks, chert, siliceous shale, pelagic shale, and fine-grained graywacke. The matrix in the olistostromes is mainly graywacke, siltstone, and shale. Local oceanic chert, mafic volcanic rocks, and clastic rocks occur in scattered nappes and thrust sheets. The Turgur subterrane is distinguished from the Galam subterrane by an absence of Silurian and Lower Devonian units. The Lower Carboniferous flora belongs to the Angara physiographic province. **REFERENCES**: Gorokhov, Karaulov, 1969, Sharuyeva, 1984, Kozlovsky, 1988

GN **Gonzha terrane (cratonal) (Western part of Russian Southeast)**—Contains two basement series: (1) Late Archean(?) metamorphic rocks composed of biotite, hornblende, garnet-biotite, pyroxene-hornblende gneiss and schist (Gonzhinsk series) that is metamorphosed to amphibolite facies; and (2) Lower Proterozoic(?) sedimentary rocks that contain lenses of mafic rocks (Chalovsk series), both metamorphosed to greenschist facies. Both series contain lenses of ultramafic rock. Ages are based on regional correlations. Early Paleozoic(?) cataclastic and foliated granitic rocks and plagiogranite occur with the metamorphic rocks. Younger Paleozoic units are Devonian and Lower Carboniferous shallow-marine clastic deposits with limestone layers (Bolsheneversk, Imchansk, Oldoisk, and Tiparinsk suites) that are faulted against the metamorphic rocks. Post-amalgamation Jurassic shallow-marine marine and nonmarine clastic rocks link the Gonzha, Oldoi, and Gar terranes. Early Cretaceous volcanic and granitic rocks of the Umlekan-Ogodzhin belt (unit uo) overlie or intrude the Gonzha, Oldoi, Mamyn, and Turan terranes. **REFERENCES**: Krasny, 1966; Shilo, 1982; Volsky, 1983; Kozlovsky, 1988

GR **Gar terrane (ophiolite) (Northwestern part of Russian Southeast)**—Consists chiefly of greenstone, metatuff, metasandstone, quartzite, phyllite, limestone, lenses of ultramafic rocks, and gabbro that are intensively deformed into schistose melange. May be of Proterozoic(?) age, but the only age constraint is clasts of ultramafic rocks and other units of the Gar terrane in the overlapping Jurassic deposits. Gar terrane characteristically contains a thick overlap assemblage of Upper Triassic clastic rocks (Kalakhtinsk, Malokalakhinsk, Naptarginsk, and Neupokoevs suites) characterized by abundant *Monotis* and *Halobia*. The Gar terrane is also overlapped by a Jurassic sedimentary rock assemblage (Uralovskinsk, Uskalinsk, Ayaksk, Depsk, and Molchanovsk suites) that also overlies the Oldoi and Gonzha terranes. **REFERENCE**: Krasny, 1966

GS **Grindstone terrane (accretionary wedge - predominantly turbidites) (Southeastern part of U.S.A. Pacific Northwest)**—Consists chiefly of a sedimentary melange composed of the Lower Mississippian Coffee Creek, Lower Pennsylvanian Spotted Ridge, and Lower Permian Coyote Butte Formations. The Grindstone terrane is interpreted as various Paleozoic olistolith blocks that are slumped into Permian and Lower Triassic flysch that formed at the base of the continental slope and in basins that were subsequently overlapped by Upper Triassic and Lower Jurassic debris- and turbidity-flow deposits (Blome and Nestel, 1991). The Grindstone terrane is overlain by the Triassic and Jurassic Snowshoe and Vesper Formations, and by the Cretaceous Bernard Formation. The Grindstone terrane may be separate from others in the Blue Mountains island arc (not defined on map) (Blome and Nestell, 1991). But Vallier (1995) and Ferns and Brooks (in press) interpret the Grindstone terrane and other parts of the Blue Mountains island arc as part of the same complex forearc region as the Baker terrane. Miller (1987) suggested that the Grindstone terrane is the northward continuation of similar terranes in the northeastern Klamath Mountains. **REFERENCES**: Miller, 1987; Blome and Nestell, 1991; Ferns and Brooks, in press; Vallier; 1995

GZ **Ganal'skiy terrane (metamorphic) (Southern part of Kamchatka Peninsula)**—Present in the southern part of the eastern Kamchatka Range. Consists chiefly of two polymetamorphic formations of uncertain age that occur in separate tectonic sheets: (1) gneiss interlayered with amphibolite, mafic schist, quartzite, and marble (Ganal'skiy series); and (2) greenschist and metavolcanic rocks that contain chert layers (Stenovaya series) and local subvolcanic quartz keratophyre and granophyre bodies. Plagiogranite with a K-Ar isotopic age of 65 Ma occurs along the boundary between the tectonic sheets. Overlain by volcanic and associated rocks of the Kuril-Kamchatka volcanic-plutonic arc (units ku, kc, ek). **REFERENCES**: Markov, 1975; German, 1978; German and others, 1976; L'vov, 1986; Luchitskaya and Rihter, 1989; Rihter, 1991

HA **Harrison Lake terrane (island arc) (Southwestern Canadian Cordillera and northwestern U.S.A. Pacific Northwest)**—Consists chiefly of: (1) Middle Triassic cherty argillite and mafic volcanic rocks (Camp Cove Formation); and (2) thick lower Middle Jurassic andesite and dacite flows, and volcaniclastic rocks (Harrison Lake Formation). Toarcian basal conglomerate of the Harrison Lake Formation conformably overlies the middle Triassic rocks and contains carbonate clasts with a crinoid-bryozoan-fusulinid fauna that are possibly similar to Permian limestone of the Chilliwack terrane (Arthur and others, 1993).

The Harrison Lake terrane is stratigraphically overlain by the Gravina-Nutzotin-Gambier volcanic-plutonic belt that to the west overlaps and intrudes the Wrangellia superterrane. In the U.S.A. Pacific Northwest, the correlative strata are the Jurassic Wells Creek Volcanics and sedimentary rocks of the Cretaceous and Jurassic Nooksack Group that are exposed in a structural window below the overthrust Chilliwack River terrane (Misch, 1966). **REFERENCES**: Misch, 1966; O'Brien and others, 1992; Arthur, and others, 1993

HE **•Henrietta terrane (passive continental margin) (East Siberian Sea)**—Exposed on Henrietta and Jeanette Islands in the Eastern Siberian Sea. Consists of a tuffaceous clastic sequence composed of quartzite, sandstone, slate, tuffaceous sandstone with layers of diabase, graywacke sandstone, and conglomerate. Weakly folded and faulted. Unconformably overlain by Cenozoic conglomerate. The clastic sequence is possibly of Carboniferous age, and is overlain by basalt and andesitic basalt that yield K-Ar ages of 310 and 375 Ma (Carboniferous) that are intruded by diabase dikes and sills. The Henrietta terrane is designated as a separate unit because the clastic rocks do not correlate with units in the subterranes of the Chukotka terrane. **REFERENCES:** Vinogradov and others, 1975, 1977; Fujita and Cook, 1990; Kos'ko and others, 1990

HI **Hidaka terrane (accretionary wedge - predominantly oceanic rocks) (Hokkaido Island, Japan)**—Consists chiefly of flysch and melange of the Hidaka Group which includes blocks of basalt, chert, limestone, siliceous shale, and sandstone within a shale matrix. The basalt occurs both as blocks in melange and as lava flows within a sedimentary succession. The Hidaka Group contains Permian fusulinids and corals, Upper Triassic sponge spicules in limestone, Upper Jurassic to Lower Cretaceous radiolarians in chert, Lower Cretaceous nannofossils in limestone, and Lower Cretaceous to Eocene radiolarians in shale. The Hidaka terrane is coeval with the Cretaceous to Paleogene subduction zone complex of the Shimanto terrane of southwestern Japan. The southwestern part of the Hidaka terrane includes high-T, low-P metamorphic rocks which range from granulite to greenschist facies. The metamorphic grades declines eastward. The main part of the metamorphic zone is composed of retrograde granulite, migmatite, and intrusive rocks that include Middle to late Tertiary granite, gabbro, and tonalite. Metamorphic K-Ar ages are 16 to 18 Ma. Isotopic ages of plutonic rocks are 10 to 43 Ma. The metamorphic rocks include a metamorphosed ophiolite succession that ranges from basal tectonites to an upper level dike complex. The Hidaka terrane is correlated with part of the Aniva terrane to the north on Sakhalin Island. **REFERENCES**: Komatsu and others, 1981, 1983; Osanai, 1985; Kawamura and others, 1986; Kiminami and others, 1986; Sakai and Kanie, 1986; Iwata and Tajika, 1989; Kato and others, 1990

HIA **Hidaka-Aniva collage (Southwest Sea of Okhotsk)**—Consists chiefly of the Kamuikotan ophiolite terrane, Hidaka accretionary wedge terrane, and Aniva accretionary wedge terrane.

HO **Hoh terrane (accretionary wedge - predominantly turbidites) (Southwestern Canadian Cordillera and northwestern U.S.A. Pacific Northwest)**—Consists chiefly of middle Miocene to upper Oligocene melange and broken formation (Silberling and others, 1987). Interpreted to underlie the entire continental shelf. Onshore, the terrane consists of sandstone and siltstone that occur in a sheared siltstone matrix on the western Olympic Peninsula (Snavely and others, 1980). Deep seismic reflection studies on Vancouver Island suggest that the Hoh terrane forms the lowest of the northeast-dipping thrust sheets that comprise the crust of Vancouver Island above the presently subducting Juan de Fuca Plate (Clowes, and others, 1987). **REFERENCES:** Snavely and others, 1980; Clowes, and others, 1987; Silberling and others; 1987

IG **Ingalls terrane (accretionary wedge and subduction zone - predominantly oceanic rocks) (North-central part of U.S.A. Pacific Northwest)**—Consists chiefly of tectonically mixed ultramafic rocks and lessor amounts of sandstone and argillite, radiolarian chert, pillow basalt, and gabbro (Southwick, 1974; Miller, 1975, 1980, 1985). Radiolarian chert and zircons from gabbro yield Late Jurassic ages. Included in the terrane is a coherent package of arc-derived metavolcanic rocks (South Peak unit) (Miller, 1980). The ultramafic rocks are fragments of mantle from an oceanic fracture zone (Cowan and Miller, 1980; Miller and Mogk, 1987). The Ingalls terrane is interpreted as having been tectonically emplaced over higher grade metamorphic rocks of the North Cascade crystalline core prior to the mid-Cretaceous (Miller, 1980, 1985; Whetten and others, 1980; Vance and others, 1980; Tabor and others, 1993). The Ingalls terrane is generally correlated with the Pacific Rim terrane. The Ingalls terrane is also called the Ingalls Tectonic Complex or the Ingalls ophiolite melange. **REFERENCES**: Southwick, 1974; Miller, 1975, 1980, 1985; Vance and others, 1980; Miller and Mogk; 1987; Tabor and others, 1993

IK **Iruneiskiy terrane (island arc) (Kamchatka Peninsula)**—Consists chiefly of several tectonic sheets overlying Cretaceous clastic deposits. In one area (Lesnov and Tagil uplifts), the major units are pillow basalt, siliceous shale, tuff, and jasper of Albian to Cenomanian age. Structurally overlying these units are Upper Cretaceous tuff and jasper, and coarse-grained, mafic, and intermediate composition volcanic breccia. In another area (Sredinnyi Range), the major units are: (1) fine-grained silicic, fine-tuffaceous deposits, and coarse-clastic tuffaceous deposits that contain Upper Cretaceous basalt layers (Iruneiskiy suite); and (2) overlying tuff-breccia and calc-alkalic volcanic rocks with tuffaceous-sedimentary lenses that grade into Maastrichtian siliceous siltstone (Kirganiksk suite) that contains benthonic foraminifera. **REFERENCES**: Shapiro and others, 1984; Shantser and others, 1985; Shantser, 1987; Zinkevich and Tsukanov, 1993

IOC **Institute of Oceanology collage (Sea of Okhotsk)**—Composed of granitic rocks, felsic volcanic rocks, biotite schist, and phyllite as indicated by dredging of uplifts of acoustic basement. K-Ar ages of plutonic rocks range from 73 to 101 Ma. Felsic volcanic rocks belong to calc-alkalic and tholeiite series and are interpreted as forming in an island arc. The southern part of the terrane is bounded by a large magnetic anomaly that is interpreted as an ophiolite that occurs at a depth of 5 to 6 km. The collage is interpreted as an island arc complex composed of a volcanic arc, related forearc basin, and ophiolite that have been tectonically embedded in an accretionary wedge. **REFERENCES**: Geodekyan and others, 1976; Kornev and others, 1982; Vasiliyev and others, 1984; Gnibidenko and Khvedchuk 1984; Sergeev and Krasny, 1987

IZ **Izee terrane (turbidite basin) (Southeastern part of U.S.A. Pacific Northwest)**—Consists chiefly of thick, mainly flyschoid, clastic sedimentary rocks and subordinate volcaniclastic rocks of Late Triassic through Middle Jurassic (Callovian) age (Throwbridge, Lonesome, Snowshoe, and Hyde Formations, Maurich Group, Keller Creek Shale, and Murderers Creek, Graylock, and Vesper Formations). Local unconformities and abundant facies changes indicate a long-lasting and complex depositional basin. Closely spaced faults and folds deform the eastern part of the terrane and further confuse stratigraphy. The Izee terrane of Silberling and others (1984) is extended by Vallier (1995) to include the Weatherby Formation of eastern Oregon and the Squaw Creek Schist of western Idaho, because of similar lithologies. The Izee terrane and associated Weatherby Formation are in fault contact with the Baker terrane to the north and with the Huntington Volcanics of the Olds Ferry terrane to the south. The Izee terrane is interpreted to have been originally deposited mostly on the Baker and Grindstone terranes. Sandstone in the Izee terrane was derived from both the Baker and Olds Ferry terranes. Late Jurassic to Early Cretaceous plutons cut the older rocks of the terrane and some link the Izee to other terranes. Overlain by the Cretaceous Bernard Formation. Named the *flysch terrane* by Brooks and Vallier (1978) and the *Mesozoic clastic terrane* by Dickinson (1979). **REFERENCES:** Brooks and Vallier, 1978; Dickinson, 1979; Silberling and others; 1984; Vallier (1995)

KB **Khabarovsk terrane (accretionary wedge - predominantly turbidites) (East-central part of Russian Southeast)**—Located in structural windows that are surrounded by overlying Cenozoic deposits of the Middle Amur sedimentary basin. Chiefly a melange with variously sized fault-bounded lenses and slices of Triassic chert, Lower to Middle Jurassic siliceous shale, hemipelagic sedimentary rocks, mafic volcanic rocks, and gabbro, Upper Carboniferous, Permian, and Upper Triassic limestone, and schist and metasandstone of unknown age. Melange also includes lenses of Tithonian-Valanginian siltstone and sandstone that are lithologically identical to matrix of melange. The intensively sheared matrix is interpreted as derived from coherently-layered thin-bedded turbidite deposits, and as fine-grained clastic olistostromes. Hauterivian-Barremian radiolarians and Barremian-Albian megafossils are present in the matrix. The Upper Paleozoic limestone locally contains volcanic rock layers and a Tethyan fauna, and is interpreted as a reef caps on seamounts. The formation of the Khabarovsk terrane is interpreted as partly synchronous with the formation of the Amur River terrane and partly with the Kiselyovka-Manoma terrane. Together these terranes are interpreted as tectonically linked to the Khingan-Okhotsk active continental margin. **REFERENCES**: Natal'in and

Alekseenko, 1989, Natal'in, Zyabrev, 1989, Shevelyov, 1987

KE **Kema terrane (island arc) (Eastern part of Russian Southeast)**—Present in the Sikote-Alin region. Consists chiefly of distal turbidite deposits, andesite and basalt flows, breccia, tuff, and interbedded shallow-marine volcaniclastic rocks that contain Aptian to Albian pelecypods. The volcanic rocks are mainly tholeiitic and calc-alkalic. Overlain by late Albian and younger igneous rocks of the East Sikhote-Alin volcanic-plutonic belt (unit es). **REFERENCE:** Simanenko, 1986

KH **Khanka superterrane (Southern part of Russian Southeast)**—Consists chiefly of the Kabarga, Sergeevka, Spassk, and Voznesen terranes. Includes overlapping units of Devonian continental-rift-related volcanic and sedimentary rocks, middle Paleozoic granitic rocks (mPzg), late Paleozoic granitic rocks (lPzg), and Permian back-arc-rift-related volcanic rocks (Pv). These middle and late Paleozoic igneous arc rocks are interpreted as either subduction-related arc (Parfenov and Natal'in, 1985; Natal'in, 1991, 1993), or backarc deposits (A.I. Khanchuk, written commun., 1993).

KHG **Sergeevka terrane (continental-margin arc) (Southern part of Russian Southeast)**—Consists chiefly of a long-lived and complex terrane composed of two major units: The oldest unit consists of syntectonic, migmatized, gneissic gabbro and quartz diorite that contain xenoliths up to several hundred meters in size. The xenoliths are composed of amphibolite, quartzite, marble, and calc-schist. The gneissic structure in the gabbro and diorite parallels the schistosity in the xenoliths. The amphibolite xenoliths are derived from oceanic tholeiite whereas the gneissic gabbro and quartz diorite are derived from a continental-margin arc. U-Pb zircon isochron isotopic analyses intrusive ages are about 500 to 527 Ma. The second unit consists of the Early Ordovician biotite-muscovite Taphuin Granite that yields a muscovite Ar-Ar age of 491 Ma. The granite forms a major thrust overlying gneissic gabbro and associated rocks. As with most of the other terranes of the Khanka superterrane, the Sergeevka terrane is overlapped by: (1) Middle and Upper Devonian felsic tuff, conglomerate, and sandstone with flora that unconformably overlie older sequences; (2) conformably overlying Lower Carboniferous nonmarine conglomerate, flora-bearing sandstone, and felsic tuff; (3) Permian conglomerate, sandstone, mudstone, basalt, andesite, rhyolite, and reef-forming limestone; (4) Upper Permian olistostromes; (5) Unconformably overlying Middle Triassic to Middle Jurassic shallow-marine marine sandstone and siltstone; and (6) conformably overlying Middle and Upper Jurassic, subduction-related(?) rhyolite, andesite, and basalt in the south, and Upper Jurassic, extension-related basalt and picrite in the north. Overlain by Cretaceous and younger terrestrial coal-bearing deposits. The Sergeevka terrane was amalgamated with other terranes of the Khanka superterrane during the early Paleozoic. In the Early Cretaceous, the Khanka superterrane was accreted to the eastern margin of Asia. The Upper Cretaceous and Paleogene calc-alkalic volcanic rocks of the East Sikhote-Alin volcanic-plutonic belt (unit es) overlap all terranes of the Sikhote-Alin region. **REFERENCES**: Krasny, 1966, 1973, Bersenev, 1969, Shilo, 1982; Nazarenko and Bazhanov, 1986; Khanchuk and others, 1988;, Sinitsa and Khanchuk, 1991; Natal'in, 1991, 1993; Khanchuk, 1993; Aleinikoff and others, in press

KHK **Kabarga terrane (continental-margin arc) (Southern part of Russian Southeast)**—Consists chiefly of six major units. (1) Relatively older Proterozoic diopside-calcite marble and calc-schist, that together have a minimum structural thickness of 1,000 m, and sillimanite-cordierite gneiss and hypersthene-magnetite-fayalite quartzite that together have a minimum structural thickness of 3,000 m. Metamorphic units display granulite and amphibolite-facies metamorphism, and yield a Rb-Sr whole-rock age of greater than 1,517 Ma. (2) Proterozoic biotite-hornblende gneiss and interlayered amphibolite with a structural thickness of 3,000 m and displays amphibolite-facies metamorphism. (3) Relatively younger Upper Proterozoic metasedimentary rocks that consist of intensely deformed graphitic pelitic schist and interlayered marble, metasandstone, and sparse intermediate metavolcanic rocks. Unit has a minimum structural thickness of several thousand meters, and displays greenschist to upper amphibolite facies metamorphism that occurs adjacent to biotite-muscovite granitic plutons that have a Rb-Sr whole rock age of 750 Ma and a K-Ar age of 650 Ma. (4) Probable Upper Proterozoic to Cambrian siliceous and nonsiliceous limestone, graphitic pelitic shale, ferromanganese and phosphate layers, and dolomite. Unit is intensely deformed with a structural thickness up to about 1 km. (5) Silurian shallow-marine and fluvial sandstone and limestone with plant fossils intruded by local Silurian collisional-related granitic plutons. And (6) younger Permian basalt, andesite, and rhyolite, and Lower Triassic sandstone. The terrane is overlain by younger Mesozoic rocks that consist of subduction-related Jurassic and Early Cretaceous (Neocomian) rhyolite and granite. The Kabarga terrane was amalgamated with other terranes of the Khanka superterrane in the early Paleozoic. In the Early Cretaceous, the Khanka superterrane was accreted to the eastern margin of Asia. The Upper Cretaceous and Paleogene calc-alkalic volcanic rocks of the East Sikhote-Alin volcanic-plutonic belt (unit es) overlap all terranes of the southern Russian Far East. **REFERENCES**: Bersenev, 1969; Mishkin, 1981; Oleinik, 1983; Nazarenko and Bazhanov, 1986; Lelikov and others, 1987; Khanchuk and others, 1988, 1989; Natal'in, 1991, 1993; Khanchuk, 1992

KHS **Spassk terrane (accretionary wedge - predominantly turbidites) (Southern part of Russian Southeast)**—Consists chiefly of a composite accretionary wedge terrane with fragments of diverse origin. Consists of four major units. (1) Undated turbidite and olistostrome deposits with limestone fragments of Tommotian age; (2) Limestone containing Atdabanian archaeocyathids and interlayered chert with a structural thickness of at least 3,000 m. (3) Ophiolite ultramafic and mafic rocks, serpentinite melange, and basalt that are overlapped by limestone and interlayered mudstone that contain Lenian archaeocyathids and trilobites, all with a minimum structural thickness of 1,700 m. And (4) conglomerate, sandstone, and siltstone derived from units (2) and (3). Unit contains Lower to Middle Cambrian trilobites and brachiopods, and Ordovician to Lower Silurian conglomerate. Intruded by middle Paleozoic, Carboniferous, and Late Permian granitic rocks, and overlain by Devonian, Mississippian, and Permian volcanic and sedimentary rocks both of which constitute postaccretion assemblages for the entire Khanka superterrane. Albian granitic rocks interpreted as forming in a subduction-related arc. The Spassk terrane amalgamated with the other terranes of the Khanka superterrane in the early Paleozoic. In the Early Cretaceous, the Khanka superterrane was accreted to the eastern margin of Asia. The Upper Cretaceous and Paleogene calc-alkalic volcanic rocks of the East Sikhote-Alin volcanic-plutonic belt (unit es) overlap all terranes of the southern Russian Far East. **REFERENCES**: Shcheka and others, 1973; Nazarenk and Bazhanov, 1987; Belyaeva, 1988; Natal'in, 1991, 1993; Khanchuk, 1993

KHV **Voznesen terrane (continental-margin arc) (Southern part of Russian Southeast)**—Forms extreme southwestern part of Khanka superterrane. Consists of four major units. (1) Cambrian sandstone, pelitic schist, rhyolite, felsic tuff, and limestone and dolomite that together are up to several thousand meters thick. The limestone contains Atdabanian to Lenian archaeocyathids. Rhyolite yields a Rb-Sr whole-rock age of 512 Ma. Cambrian rocks are intensely deformed and intruded by Ordovician collision-related granitic rocks with Rb-Sr whole-rock ages of up to 480 Ma. (2) Conglomerate and sandstone of Ordovician to Lower Silurian age according to questionable flora. (3) Lower Devonian rhyolite and felsic tuff, Middle to Upper Devonian rhyolite, felsic tuff, and rare basalt. Unit contains intercalated terrestrial rocks and shallow-marine clastic rocks with limestone lenses, and Lower to Middle Carboniferous rhyolite, silicic tuff, siltstone, and limestone lenses with Tethyan forminiferas. And (4) Upper Permian basalt, andesite, rhyolite, sandstone, and siltstone which contain plant fossils.

Various Mesozoic and Cenozoic volcanic and sedimentary units overlap the terrane: (1) Lower and Middle Triassic marine clastic rocks; (2) overlying Upper Triassic interbedded marine and nonmarine coal-bearing clastic rocks; (3) marine Jurassic deposits that contain an abundant fauna; (4) Hauterivian-Albian and younger Cretaceous clastic coal-bearing rocks that also unconformably overlie the Laoelin-Grodekovsk and the Sergeevka terranes of the Khanka superterrane; (5) Upper Cretaceous and Paleogene calc-alkalic volcanic rocks of the East Sikhote-Alin volcanic-plutonic belt (unit es) that overlap all terranes of the southern Russian Far East; and (6) younger Cenozoic deposits including Paleogene and early Neogene epicontinental sedimentary deposits, and late Neogene alkalic basalt of the Sakhalin-Primorye volcanic belt (unit sp). The Voznesen terrane was amalgamated with other terranes of the Khanka superterrane in the early Paleozoic. In the Early Cretaceous, the Khanka superterrane was accreted to the Asia eastern margin. **REFERENCES**: Geology of the U.S.S.R., 1969; Goroshko, 1983; Oleinik, 1983; Nazarenko and Bazhanov, 1987; Belyaeva, 1988; Khanchuk and others, 1991; Izosov, 1992; Androsov, 1992

KI **Kilbuck-Idono terrane (cratonal) (Southwestern and west-central Alaska)**—Present in two fault-bounded fragments about 330 km apart. Consists chiefly a unit of metamorphosed diorite, tonalite, trondhjemite, and granite orthogneiss, subordinate amphibolite, and minor metasedimentary rocks. Metasedimentary rocks are mainly quartz-mica schist, marble, garnet amphibolite, and banded iron formation of the informally named Kanektok metamorphic complex of

Hoare and Coonrad (1979). Metaplutonic rocks yield Early Proterozoic (2.06 to 2.07 Ga) U-Pb zircon ages of emplacement. Nd-Sm isotopic analyses indicate a 2.5 Ga (Archean) crustal component. The terrane is metamorphosed to amphibolite facies with retrograde greenschist-facies metamorphism, possibly in the late Mesozoic. A southern fragment constitutes the Kilbuck terrane of Box and others (1990, 1993); a northern fragment constitutes Idono Complex of Miller and others (1991). The terrane is unconformably overlain by the Cretaceous sedimentary rocks of Kuskokwim Group (unit kw). The Kilbuck-Idono terrane is interpreted as a displaced cratonal fragment with no known correlative cratonal rocks in North America. Possibly displaced from either the North Asian craton, the Omolon terrane of the Kolyma-Omolon superterrane, or the Okhotsk terrane. **REFERENCES**: Hoare and Coonrad, 1978, 1979; Turner and others, 1983; Box and others, 1990, 1993; Miller and others, 1991

KK **Kamuikotan terrane (subduction zone - predominantly oceanic rocks) (Hokkaido Island, Japan)**—Consists chiefly of high-pressure metamorphic rocks, serpentine melange, and ophiolite (Horokanai Ophiolite). The serpentinite melanges include numerous blocks of metamorphic rocks. The high-pressure metamorphic rocks locally contain jadeite or lawsonite. The Horokanai Ophiolite is composed of ultramafic rocks (dunite, harzburgite, lherzolite, olivine-clinopyroxenite), metagabbro, pillow basalt, and chert, in ascending order. K-Ar and Ar-Ar ages from Horokanai Ophiolite are 100-125 Ma. **REFERENCES**: Ishizuka, 1980; Watanabe, 1981; Maekawa, 1983; Kato and Nakagawa, 1986; Kato and others, 1990

KL **Kholodzhikan terrane (turbidite basin) (Northwestern part of Russian Southeast)**—Consists chiefly of Upper Jurassic sandstone, conglomerate, siltstone, and shale (Kholodzikansk suite), that are overlain by Lower Cretaceous conglomerates, sandstones and siltstones (Ugansk suite). Local Late Jurassic and Early Cretaceous mafic dikes. The Upper Jurassic rocks are structurally, and perhaps originally unconformably, overlay Middle and Upper Triassic marine clastic rocks of the Uniya-Bom terrane. The Kholodzhinkan terrane is interpreted as a foredeep basin formed during accretion of Uniya-Bom and Tukuringra-Dzhagdi terranes to the North Asian platform. **REFERENCE**: Kozlovsky, 1988

KLM **Kiselyovka-Manoma terrane (accretionary wedge - predominantly oceanic rocks) (Eastern part of Russian Southeast)**—Located in a narrow band along the southern side of the Amur River terrane, north of the Amur fault. The stratigraphy and structure are poorly known. Distinguished from the Khabarovsk, Amur River, and Samarka terranes by the presence of Jurassic and Lower Cretaceous ribbon chert and siliceous shale, and Cretaceous flysch. Jurassic basalt and Lower Jurassic limestone also present in contrast to other terranes in this region. Chert and mafic volcanic rocks are present in both tectonic sheets and in olistoliths in the Early Cretaceous olistostrome. The Kiselyovka-Manoma terrane is interpreted as tectonically linked to the Khingan-Okhotsk active continental margin. **REFERENCES**: Filippov, 1988, Kuzmin, Kaidalov, 1990; Shevlyov, 1990, Natal'in, 1991

Kony-Murgal terrane (island arc) (Southeastern part of Russian Northeast)—Consists of the Murgal and Taigonos subterranes that are composed chiefly of a Late Jurassic and Early Cretaceous sequence of island arc volcanic, plutonic, and related sedimentary rocks. Locally extensively overlain by the Okhotsk-Chukotka volcanic-plutonic (unit oc) and Kamchatka-Koryak (unit kk) volcanic belts.

KMM **Murgal subterrane (island arc) (Southeastern part of Russian Northeast)**—Consists chiefly of Upper Jurassic to Hauterivian folded island arc volcanic and sedimentary rocks. Volcanic units are mainly basalt, andesite-basalt, andesite, and tuff, but alternate with and locally replaced by shallow-marine and nonmarine volcaniclastic rocks that locally contains macrofossils. The terrane also contains Late Jurassic and Early Cretaceous (pre-Albian) granodiorite, tonalite, plagiogranite, and quartz diorite. The Murgal subterrane separated from the Taigonos subterrane by Cretaceous continental-margin arc igneous rocks of the Okhotsk-Chukotka volcanic-plutonic belt (unit oc) which overlies both subterranes. **REFERENCES**: Belyi, 1977; Kovaleva, 1985; Filatova, 1986

KMT **Taigonos subterrane (island arc) (Southeastern part of Russian Northeast)**—Chiefly a thick assemblage of shallow marine and continental (upper part) volcanic and volcaniclastic rocks of Late Permian to Neocomian age that contains a Boreal fauna, and abundant and diverse macrofossils and flora. Igneous rocks are mainly andesite, andesite-basalt, andesite-dacite, and basalt tuff.

Silicic volcanic rocks are present in the upper part. Sedimentary rocks include volcaniclastic sandstone, siltstone, grit, and conglomerate that contain coarse parallel bedding, cross bedding, and oscillation ripple marks. In the northern part of the subterrane are widespread thick beds of graywacke and clay shale that along strike replace the largely volcanogenic sequences that occur in the southern part of the subterrane. Deformed into compressed, elongated, southeast-verging folds with vertical to steep axial planes. The terrane is intruded by diorite, gabbro, and numerous granitic plutons that yield K-Ar isotopic ages of 75 to 115 Ma. Overlain by the Okhotsk-Chukotka volcanic-plutonic (unit oc) and Kamchatka-Koryak (unit kk) volcanic belts. **REFERENCES**: Zaborovskaya, 1978; Parfenov, 1984; Kovaleva, 1985; Nekrasov, 1986; Filatova, 1988

KO **Kootenay terrane (metamorphosed continental margin) (Southeastern part of Canadian Cordillera)**—Consists chiefly of Proterozoic(?), Paleozoic(?), and Triassic clastic rocks, mafic to felsic volcanic rocks, minor carbonate rocks, and Paleozoic granitic rocks, typically highly deformed and variably metamorphosed. The Kootenay terrane is located between Devonian and younger volcanogenic, accreted terranes to the west, and Middle Proterozoic and younger North American cratonal strata to the east. Similar terranes, including the Yukon-Tanana, Ruby, Coldfoot, and Seward terranes, occur in about the same spatial relationship to other terranes, and extend along the margin of western North America from California to Alaska to the Russian Northeast. In various places, these terranes record mid-Paleozoic, Permo-Triassic, and Jurassic through early Tertiary deformations. The strata in the Kootenay terrane possibly were deposited on thinned extended continental crust or oceanic crust adjacent to the craton.

The Kootenay terrane overlies with probable stratigraphic but possible structural contact Upper Proterozoic and Lower Cambrian strata (Horsethief Creek, Hamill and Badshot units) that are westerly facies equivalents of Windermere and Lower Cambrian strata of the craton margin (J.O. Wheeler, written comm. 1982; Smith and Gehrels, 1991). Probably conformably but possibly structurally overlying these units are Cambrian and Ordovician continent-derived siliciclastic rocks and pelitic rocks (Lardeau Group; Broadview and Covada grits; Sicamous Formation), subordinate mafic to felsic volcanic rocks (Jowett; Eagle Bay formations), and Devonian and local Ordovician granitic plutons (Okulitch, 1985). These units were deformed and metamorphosed prior to the deposition of Upper Mississippian strata, a deformational event possibly equivalent to the Antler orogeny of the western conterminous United States (Fyles and Eastwood, 1962; Read and Wheeler, 1976). U-Pb ages from detrital zircons in the clastic rocks indicate derivation from western North America (Smith and Gehrels, 1991). The early Paleozoic rocks are unconformably overlain by Carboniferous conglomerate, sandstone, shale, carbonate, and mafic volcanic rocks (Milford Group) that are probable lateral equivalents of parts of the Slide Mountain terrane (Klepacki, 1983). These rocks were deformed in the Permian to Triassic possibly during the Sonoman orogeny of the western conterminous United States, and later juxtaposed with the Slide Mountain and Quesnellia terranes (Read and Okulitch, 1977; Klepacki, 1983). In the Middle Jurassic, the Kootenay and the structurally overlying Quesnellia and Slide Mountain terranes were thrust eastward over North American cratonal rocks (Archibald and others, 1983; Brown and others, 1986). **REFERENCES:** Fyles and Eastwood, 1962; Read and Wheeler, 1976; Read and Okulitch, 1977; Archibald and others, 1983; Klepacki, 1983; Okulitch, 1985; Brown and others, 1986; Smith and Gehrels, 1991

Kolyma-Omolon superterrane (Russian Northeast) (Central part of Russian Northeast)—Consists of a large number of cratonal, passive continental margin, island arc, accretionary-wedge, and minor oceanic crust and ophiolite terranes. The superterrane is overlain by the mainly Middle Jurassic to Early Cretaceous Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (unit io) that is interpreted as a pre-accretion marginal island arc assemblage. The superterrane was accreted to the North Asian craton (unit NSC) and the North Asian craton margin (unit NSV) during the Late Jurassic and Early Cretaceous. The region of the suture (the Adycha-Taryn thrust fault, fault *AD*) between the Kolyma-Omolon supper terrane and North Asian craton margin is intruded by the Late Jurassic and Early Cretaceous Verkhoyansk collisional granite belt (unit vk). The eastern margin of the superterrane is locally extensively overlapped by the Cretaceous and Paleocene Okhotsk-Chukotka volcanic-plutonic belt (unit oc).

KOAC **Aluchin terrane (subduction zone - predominantly oceanic rocks) (Central part of Russian Northeast)**—Consists chiefly of: (1) dismembered ophiolites of presumed middle Paleozoic age, including harzburgite, pyroxenite, dunite, lherzolite, gabbro, plagiogranite, a mafic dike suite, basalt, and local glaucophane schist; (2)

tectonic lenses of Middle Carboniferous to Lower Permian island arc clastic-tuffaceous deposits, basalt, and andesitic basalt that are intruded by diorite and tonalite; and (3) unconformably overlying Triassic (Norian) shallow-marine volcanic and sedimentary rocks, and Lower Jurassic clastic deposits that contain pebbles of the underlying diorite and tonalite. The terrane is overlapped by the Middle Jurassic to Early Cretaceous Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (unit io). **REFERENCES**: Dovgal', 1964; Shilo and others, 1973; Dovgal' and others, 1975; Markov and others 1980; Lychagin and others, 1989; Byalobzhesky and others, 1990; Seslavinskiy and Ged'ko, 1990

KOAG **Argatas terrane (subduction zone - predominantly oceanic rocks) (Central part of Russian Northeast)**—Consists chiefly of Ordovician shale, Devonian ophiolite, and Carboniferous, Permian, and Triassic deep-water chert, mudstone, siltstone, tuff, trachybasalt, and rare limestone. Intensely deformed. Contains a microfauna and rare macrofossils. Separated from the Rassokha terrane to the south by a south-verging thrust. The Argatas terrane is overlapped by the Middle Jurassic to Early Cretaceous Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (unit io). The Argatas terrane is interpreted as a subduction zone assemblage that was tectonically paired to the Alazeya island arc terrane (Kolyma-Omolon superterrane). **REFERENCES**: Terekhov and Dylevsky, 1988; Gagiev and Lychagin, 1990

KOAL **Alazeya terrane (island arc) (North-central part of Russian Northeast)**—Occurs in the center of a vast boggy plain between the interfluve of the Kolyma and Indigirka Rivers. Consists chiefly of: (1) Kenkel'Dinskaya Formation which is composed of an intensely deformed tectonic melange of deep-water basalt, chert, graywacke, glaucophane schist, and greenschist of unknown age; and (2) a thick sequence of Carboniferous to Lower Jurassic littoral-marine and shallow-marine tuff of intermediate, mafic, and siliceous composition, graywacke, grit, and conglomerate with rare lava horizons. Contains an upper Paleozoic and Mesozoic Boreal fauna, and stratigraphic gaps occur at the base of Carboniferous, Upper Permian, and Upper Triassic units. The Alazeya terrane is overlapped by the Middle Jurassic to Early Cretaceous Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (unit io). **REFERENCES**: Lychagin and others, 1975, 1977; Rusakov and others, 1975, 1977; Grinberg and others, 1981

KOB **Beryozovka terrane (turbidite basin) (North-central part of Russian Northeast)**—Present in a series of tectonic sheets that are thrust southward over the northern margin of the Omolon terrane. Consists of: (1) a basal section of deep- and shallow-marine basalt, rhyolite, siliceous siltstone, chert, sandstone, and conglomerate that formed in a rift setting and that contains Upper Devonian conodonts and radiolarians, and Lower Carboniferous foraminiferas, conodonts, and macrofossils; and (2) Middle and Upper Carboniferous to Lower Jurassic chert, siltstone, mudstone, and shale with pelitomorphic limestone layers and argillaceous-calcareous concretions with local brachiopods and *Goniatites*. The Beryozovka terrane and adjacent margin of the Omolon terrane are unconformably overlain by Upper Jurassic gently-dipping shallow marine deposits of the Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (unit io), and by the Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Shul'gina, 1980; Terekhov and others, 1984; Gagiev and others, 1987; Shul'gina and others, 1990; Natapov and Shul'gina, 1991

KOKN **Kular-Nera terrane (accretionary wedge - predominantly turbidites) (Central part of Russian Northeast)**—Forms a broad, northwest-trending belt and consists chiefly of: (1) a thick assemblage of Permian, Triassic, and Lower Jurassic hemipelagic and pelagic mudstone, siltstone, and minor sandstone; and (2) Permian (Selennyakh Range) and Lower Jurassic (Nera River) radiolarian chert and tuff. The Kula-Nera terrane is interpreted as a deep-sea-fan complex that contains interbedded with continental rise and marginal sea pelagic deposits that formed between the passive margin of the Siberian continent (North Asian craton margin, unit NSV) and terranes to the east. The Kular-Nera terrane is weakly to highly metamorphosed and deformed, and exhibits lower greenschist and locally epidote-amphibolite facies metamorphic assemblages. The Kular-Nera terrane is overlapped by the Middle Jurassic to Early Cretaceous Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (unit io). The Kular-Nera terrane is locally deformed into gently inclined appressed and superposed folds, and is separated from the Verkhoyansk foldbelt to the west by the Adycha-Taryn fault. **REFERENCES**: Dagis and others, 1979; Parfenov and Trushchelev, 1983; Parfenov and others, 1988, 1989; Bychkov and Kiseleva, 1990

KOKT **Khetachan terrane (island arc) (North-central part of Russian Northeast)**—Occurs on the east bank of the Kolyma River. Consists chiefly of Upper Triassic to Lower Jurassic island-arc rocks. Northern part consists of: (1) strongly deformed thick Upper Triassic to Lower Jurassic volcanic and sedimentary units including Norian tuff, volcanogenic sandstone, grit, and conglomerate and lesser mafic to intermediate tuff and calc-alkalic lava flows (shoshonitic trachybasalt, basalt, and andesite-basalt, subordinate andesite, trachyandesite, and minor dacite, and interbedded siltstone, argillite and limestone; and (2) Lower Jurassic siltstone and volcaniclastic sandstone and conglomerate, and interbedded basaltic and andesitic tuff and flows. Southern part consists of Carnian to middle Norian volcaniclastic sandstone, argillite, siltstone, grit, and volcanic conglomerate. The Khetachan terrane is locally intruded by Late Triassic syenite and diorite. For paleomagnetic determinations, one grade C data point for mid-Cretaceous sedimentary rocks yield no latitudinal displacement with respect to the Siberian platform; however the error range allows displacements of up to 34°. The Khetachan terrane is overlapped by the Middle Jurassic to Early Cretaceous Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (unit io). **REFERENCES**: Pechersky, 1973; Sosunov and others, 1982; Afitsky and Lychagin, 1987; Natapov and Shul'gina, 1991

Oloy Terrane of Kolyma-Omolon superterrane (North- to east-central part of Russian Northeast)

KOLE **Eropol subterrane (island arc) (North- to east-central part of Russian Northeast)**—Consists chiefly of two major units. (1) A lower unit of Middle to late Paleozoic calc-alkalic mafic, intermediate and abundant felsic volcanic rocks, subvolcanic bodies of rhyolite and rhyodacite, siliceous and carbonaceous argillite, tuff, volcaniclastic sandstone, conglomerate, grit, and pelitomorphic, bioclastic, and organogenic limestone that contain foraminiferas, brachiopods, corals, and pelecypods of Middle and Late Devonian, Early and Middle Carboniferous, and Early Permian age. The Oloy terrane contains Carboniferous and Permian floras. The Devonian volcanic rocks and sedimentary rocks are intruded by small granitic plutons of pre-Late Devonian age. And (2) an upper unit of unconformably overlying Middle and Upper Triassic volcaniclastic sandstone and limestone. For paleomagnetic determinations, a grade C determination from Lower Cretaceous sedimentary rocks (Umkuveyem Depression) yield a slight northerly displacement of -15°±7° with respect to the Siberian platform. The Eropol subterrane is overlapped by the Middle Jurassic to Early Cretaceous Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (unit io). **REFERENCES**: Pechersky, 1970; Til'man and others, 1977; Lychagin and others, 1989

KOLO **Oloychan subterrane (island arc) (North- to east-central part of Russian Northeast)**—Consists chiefly of: (1) schist and marble, previously interpreted as Precambrian, but now interpreted as early Paleozoic, metamorphosed Devonian carbonate rocks, chert, and subalkalic basalt; (2) basalt and andesite flows and tuffs, siltstone, and volcanic sandstone that contain a Middle and Upper Carboniferous fauna; (3) unconformably overlying shallow-marine clastic deposits with layers of spongolite and limestone containing Permian foraminifera and pelecypods; and (4) a tectonic lens of Norian marine tuff, sandstone, and siltstone. The Oloychan subterrane is overlapped by the Upper Jurassic volcanic and sedimentary rocks of the Oloy-Svatoy Nos volcanic belt (part of the Indigirka-Oloy assemblage, unit io), and the Cretaceous and Paleocene Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Shul'gina and others, 1990; Natapov and Shul'gina, 1991

KOLS **Siverskiy subterrane (island arc) (North- to east-central part of Russian Northeast)**—Consists chiefly of: (1) mica-quartz-albite schist of unknown origin and age; (2) structurally adjacent Middle Devonian gently-folded rhyolite, tuff, and coral-bearing limestone; (3) structurally adjacent Middle to Upper Carboniferous shallow-marine basalt, andesite basalt, tuff, chert, sandstone, grit, and conglomerate; and (4) tectonic lenses of Permian siltstone, and Upper Triassic sandstone, grit, and intermediate tuff. The Siverskiy subterrane is unconformably overlain by the Upper Jurassic volcanic and sedimentary rocks of the Oloy-Svatoy Nos volcanic belt (part of the Indigirka-Oloy assemblage, unit io). **REFERENCES**: Sizykh, 1973; Shul'gina and others, 1990; Natapov and Shul'gina, 1991

KOM **Munilkan terrane (ophiolite) (Northwestern part of Russian Northeast)**—Consists chiefly of the early Paleozoic(?) Kalgyn ophiolite which is composed of serpentinized harzburgite, dunite, cumulate gabbro, amphibolite, and metabasalt with an Ar-Ar actinolite age of 415 Ma for metamorphism of the amphibolite. The terrane comprises several tectonic sheets that structurally overlie the early to middle Paleozoic carbonate deposits of the Omulevka terrane. **REFERENCES**: Shishkin, 1980; Dolgov and others, 1983; Arkhipov, 1984; Oxman, 1989; Parfenov and others, 1989; Layer and others, 1993

KOO **Omolon terrane (cratonal) (Southeastern part of Russian Northeast)**—Adjoins the Prikolyma terrane to the west. Consists of a long-lived succession of units. (1) At the base, an interpreted uniform block of Archean to Early Proterozoic crystalline basement (Terekhov and others, 1984). Archean units, exposed in small outcrops and metamorphosed at granulite and amphibolite facies, have U-Pb ages of 2.8 to 3.4 Ga and Rb-Sr ages of 3.85 Ga. (2) Unconformably overlying gently-dipping low-grade Proterozoic conglomerate, sandstone, and siltstone that grade upward into limestone, quartzite, siltstone, and marl, and Vendian dolomite. (3) Unconformably overlying rift-related Cambrian units that consist of nonmarine sandstone, conglomerate, siltstone, and alkalic basalt. The top part consists of locally fossiliferous dolomite, limestone, sandstone, and siltstone. Unit contains widespread sills and stocks of Middle Cambrian rift-related layered gabbro. (4) Lower and Middle Ordovician units comprise several small tectonic blocks and consist of shallow-marine fossiliferous limestone, dolomite, sandstone, and conglomerate. And (5) unconformably overlying widespread gently-dipping Middle and Upper Devonian calc-alkalic lava, rhyolite tuff, trachyte, trachyandesite, and basalt that is interlayered with nonmarine sandstone, conglomerate, and siltstone that are interlayered with rare shallow-marine fossiliferous deposits. Devonian volcanic and associated rare granitic plutonic rocks constitute part of the preaccretion Kedon continental-margin arc.

For paleomagnetic determinations, two grade D results from Upper Devonian shelf sedimentary rocks yield southerly displacements, but with error bars which allow for zero relative motion between the localities and the Siberian platform ($9^o \pm 9^o$ and $3^o \pm 19^o$). In contrast, five grade C data sets from mainly sedimentary rocks ranging in age from Upper Triassic to Upper Cretaceous yield southerly displacements which vary systematically from an Upper Triassic maximum displacement of $28^o \pm 8^o$ to Upper Jurassic and Cretaceous displacements of $1^o \pm 12^o$ and $4^o \pm 20^o$, respectively. The grade C data indicate a clear northward motion between the Middle Triassic to the Upper Jurassic, but the grade data D require that the whole package moved southwards with respect to the Siberian platform by the same amount in the middle to late Paleozoic. The Omolon terrane is transgressively overlain by: (1) Carboniferous to Lower Jurassic shallow-marine siltstone with lesser sandstone and argillite; (2) the Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (Middle and Jurassic to Early Cretaceous) (unit io); and (3) the Cretaceous and Paleocene Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Pechersky, 1970, 1973; Khramov, 1979; Bibikova and others, 1981; Terekhov and others, 1984; Khramov, 1986; Zhulanova, 1990; Natapov and Shul'gina, 1991

KOP **Prikolyma terrane (passive continental margin) (Central part of Russian Northeast)**—Consists chiefly of several major units. (1) At base of is a unit of high-grade gneiss and schist, metamorphosed up to amphibolite facies, interpreted as late Precambrian to early Paleozoic (Shishkin, 1979) or Pre-Vendian (Surmilova, 1990) or as Early Precambrian (Grinberg and others, 1981). Gneiss with Pb-Pb zircon age of 2360±90 Ma, and granite with Pb-Pb age of 1735±20 Ma. (2) Riphean, Vendian, and Cambrian shallow-marine clastic and carbonate rocks in the central part of Prikolyma terrane; (3) Ordovician and Lower Silurian shallow-marine carbonate and clastic rocks in southwestern part of terrane. (4) Devonian and Lower Carboniferous shallow water limestone, dolomite, marl, sandstone, siltstone, and conglomerate, with diverse macro- and microfauna. (5) In the central and eastern parts of the terrane are abundant Upper Devonian to late Paleozoic clastic rocks, including conglomerate, and along the southeastern boundary is a thick sequence of marine sequence of mainly thin-bedded clastic and volcaniclastic rocks and subordinate carbonate rocks of Late Devonian to Middle Carboniferous age, and locally Lower Permian age that contain conodonts, foraminiferas, goniatites, and brachiopods. (6) Upper Carboniferous and Lower Permian rift-related alkalic basalt flows and tuff, and alkalic gabbro sills, stocks, and dikes (Chakhadanskaya Formation). And (7) Upper Triassic and Lower Jurassic shallow-marine shale, siltstone, sandstone, and tuff in the southwestern part of the terrane. The terrane is overlain by the Jurassic volcanic rocks and intruded by coeval Jurassic granitic rocks of the Uyandina-Yasachnaya volcanic-plutonic belt (part of the Indigirka-Oloy sedimentary-volcanic-plutonic assemblage, unit io). **REFERENCES**: Shiskin, 1979; Surmilova, 1980, 1990; Grinberg and others, 1981; Tret'yakov, 1989; Natapov and Shul'gina, 1991; Beus and Miledin, 1990

KOR **Rassokha terrane (oceanic crust) (Central part of Russian Northeast)**—Consists from base to top chiefly of six units: (1) Cambrian sandstone, grit, and conglomerate that is composed of serpentinite, jasper, and basalt fragments in a serpentinite matrix; (2) unconformably overlying Ordovician pelagic shale, graywacke, alkalic basalt, and trachyte deposited below the carbonate compensation depth; Graptolite and brachiopod fauna; (3) unconformably overlying Devonian shallow-marine marine limestone, dolomite, gypsum, shale, and conglomerate; (4) Carboniferous and Permian sandstone, argillite, siltstone, and chert that are similar to coeval strata in the Omulevka terrane; (5) Middle and Upper Triassic sandstone, argillite, siltstone, sparse chert, conglomerate, basalt, and andesite to basalt tuff; and (6) Lower Jurassic mudstone and siltstone with a microfauna.

For paleomagnetic determinations, one set of localities of Upper Devonian to Lower Carboniferous intrusive, extrusive and sedimentary rocks yield grade B data. These data indicate a southerly displacement with respect to the Siberian platform of $60^{o}\pm10^{o}$. If this locality moved as part of the Omolon terrane package, it is difficult to reconcile these data with the Upper Devonian data determined for the Omolon terrane. The Rassokha terrane is overlain by Jurassic volcanic rocks and intruded by coeval Jurassic granitic rocks of the Uyandina-Yasachnaya volcanic-plutonic belt (part of the Indigirka-Oloy sedimentary-volcanic-plutonic assemblage, unit io). **REFERENCES**: Merzlyakov, 1971; Merzlyakov and Lychagin, 1979; Bulgakova, 1986; Natapov and Surmilova, 1986; Kropachev and others, 1987; Iosifidi, 1989

KOV **Omulevka terrane (passive continental margin) (South-central part of Russian Northeast)**—Consists from base to top chiefly of five units: (1) presumed Late Precambrian marble, schist, and metavolcanic rocks; (2) an unconformably overlying thick unit (up to 1700 m thick) of boulder conglomerate that contains pebbles of native and exotic rocks, and marble with Middle and Upper Cambrian fossils, schist, metarhyolite, and quartzite; (3) a thick sequence of Ordovician, Silurian, Devonian, and Lower Carboniferous fossiliferous carbonate rocks that include limestone, dolomite, and marl, and sparse sandstone, siltstone, and mudstone; (4) Carboniferous and Permian fossiliferous tuff, chert, shale, limestone, siltstone, and sandstone; and (5) Triassic fossiliferous siltstone, mudstone, marl, and shaley limestone. Along the southeast border of the terrane is a unit of Givetian calcareous sandstone that contains marine trachybasalt flows. The deep-water siltstone, argillite, and chert that prevail in Famennian-Lower Triassic section are accompanied by subordinate andesite and basalt tuff, and limestone. Except for the Upper Permian, the Upper Paleozoic units contain numerous diabase sills that were folded together with the host rocks. For paleomagnetic determinations, grade A paleomagnetic directions are determined for sedimentary rocks from two localities, one of Upper Jurassic age, and the other of Middle Jurassic age. These determinations indicate a southward displacement with respect to the Siberian platform of $20^{o}\pm10^{o}$ for the older locality, and about $15^{o}\pm40^{o}$ for the younger locality. The Omulevka terrane is overlain by Jurassic volcanic rocks and intruded by coeval Jurassic granitic rocks of the Uyandina-Yasachnaya volcanic-plutonic belt (part of the Indigirka-Oloy sedimentary-volcanic-plutonic assemblage, unit io). **REFERENCES**: Merzlyakov, 1971; Bulgakova, 1986; Natapov and Surmilova, 1986; Parfenov, 1991; Neustroev and others, 1993

KOY **Yarakvaam terrane (island arc) (Northeastern part of Russian Northeast)**—Consists from bottom to top chiefly of: (1) a tectonic sheet of Devonian(?) layered gabbro, pyroxenite, peridotite, and amphibolite (Gromadnenskiy massif) that occurs mainly in the northern part of the terrane and is interpreted as basement for the volcanic arc; (2) conglomerate, volcanogenic grit and sandstone, siliceous and carbonaceous argillite, calcareous sandstone and siltstone, subordinate limestone, and mafic to felsic flows and associated fine- to coarse-grained tuff with Lower and Upper Carboniferous faunas and an Lower to Middle Carboniferous flora. And (3) Permian and Lower Triassic conglomerate and limestone that contains conodonts, and basalt, andesite, dacite, rhyolite, and tuff. Unit intruded by coeval Permian to Triassic tonalite, quartz diorite and plagiogranite, gabbro-norite, gabbro, pyroxenite, peridotite, and anorthosite. Unconformably overlying units are: (1) shallow-marine Ladinian and Norian conglomerate, grit, sandstone, shale, and intermediate and felsic tuff with a mixed Tethyan-Boreal fauna; (2) Jurassic shallow-marine clastic rocks which grade to the north into turbidite deposits and tuff that together are part of the Indigirka-Oloy sedimentary-volcanic-plutonic assemblage (unit io); and (3) the Cretaceous and Paleocene Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Afitskiy, 1970; Radzivill, 1972; Lychagin and others, 1991; Bychkov and Solov'ev, 1991

KR **Khor terrane (continental-margin arc) (Eastern part of Russian Southeast)**—Present in a narrow, fault-bounded wedge along the Cretaceous sinistral-slip Central Sikhote-Alin fault. The Khor terrane, surrounded by the Samarka terrane, consists of gneiss, quartzite, and pelitic schist that is metamorphosed to amphibolite and greenschist facies. Magmatic rocks of the terrane are plagiogranite and leucogranite. The gneiss has a Rb-Sr isotopic age of 227 Ma. The Khor and companion Anui terranes are interpreted as parts of a single microcontinent that collided with the eastern margin of Asia at the beginning of the Cretaceous. The Khor terrane may correlate with the Sergeevka terrane. **REFERENCES:** Zmievsky, 1980; Martynyuk, Mikhalev, Popeko, 1986

KRO **Kronotskiy terrane (island arc) (Eastern Kamchatka Peninsula-Kronotskiy and Shipunskiy Peninsulas)**—Consists chiefly Conacian to early Paleocene island-arc basalt, lava and tuff breccia that contain hyaloclastite fragments of mafic and silicic volcanic rocks in a coarse-grained tuff, and chert (Mys Kamenistyi complex and Kronotskaya suite). Locally contains a serpentinite melange with ophiolite fragments. The Mys Kamenistyi complex contains a nappe structure and is overlain by volcaniclastic and volcanic deposits of the Eocene Kronotskaya suite. Overlain by sedimentary rocks of the early Tertiary Tushevka basin.

For paleomagnetic determinations, Eocene volcanic and sedimentary rocks yield grade B data which indicate a southerly displacement with respect to the Siberian platform of $24^{o}\pm10^{o}$. The data pass the criteria for grade A; however, the authors note systematicaly lower displacements are recorded by the few basalts sampled, and interpret this as an inclination bias in the data from the sedimentary rocks. The Kronotskiy terrane is overlain by the early Tertiary East Kamchatka volcanic belt (unit ek). **REFERENCES**: Raznitsyn and others, 1985; Khubunaya, 1987; Tsukanov, 1991; Bazhenov and others, 1992

KS **Kamchatskiy Mys terrane (oceanic crust) (Eastern Kamchatka Peninsula-southern Kamchatka Mys Peninsula)**—Occurs in a major nappe that contains two major units: (1) a basal part that consists chiefly of gabbro, diabase, and basalt (Olenegorsky complex) that yield Jurassic and Cretaceous K-Ar isotopic ages; and (2) a structurally overthrust unit composed of basalt, intensely-deformed deep-water chert and mudstone, clastic, and tuffaceous-sedimentary deposits of Early Cretaceous and Paleocene age that contains a local serpentinite melange with fragments of ophiolites (Afrikansy Complex). The Kamchatskiy Mys terrane may be accreted oceanic crust basement derived from near the western terminus of the Aleutian arc (Geist and others, 1991, 1994). **REFERENCES**: Markov, 1975; Zinkevich and others, 1985, 1989; Fedorchuk and others, 1988, 1989, 1990; Geist and others, 1991, 1994; Zinkevich and Tsukanov, 1993; Zinkevich and others, 1993

KT **Kotel'nyi terrane (passive continental margin) (New Siberian Islands-Kotel'nyi and Bel'kov Islands)**—Consists of following units. (1) A thick (up to several kilometers) unit of shallow-marine limestone, dolomite, coquina, marl, and limestone breccia of Ordovician, Silurian, Devonian, and Early Carboniferous age that is interlayered with local conglomerate, mudstone, siltstone, and sandstone. Unit contains an abundant and diversified coral, ostracod, brachiopod, and gastropod fauna similar to fauna of the Siberian platform. (2) In the southwest part of the terrane are Upper Devonian and Lower to Middle Carboniferous turbidites composed of deep-water mudstone, siltstone, sandstone, and limestone. (3) In the northern and central parts of the terrane are Lower to Middle Carboniferous and Lower Triassic sedimentary rocks. The Carboniferous and Permian deposits consist of thin conglomerate, siltstone, and sandstone beds. A stratigraphic hiatus occurs at the base of the Triassic units. And (4) conformably overlying Jurassic black shale(up to 2000 m thick) that contains interlayered fossiliferous limestone that contains pelecypods, ammonites, foraminifers, crinoids, wood detritus, plant spores, and pollen. The southern part of the terrane contains only Upper Triassic units and the relationships with the Paleozoic units are not clear. Recent studies suggest that thrusts may be widespread and that the Paleozoic units structurally overly Mesozoic units (G. Aulov, written commun., 1992). The Paleozoic and Mesozoic deposits of the terrane are codeformed into northwest-trending folds with steep axial surfaces. The age of folding is interpreted as Carboniferous (Kos'ko and others, 1990).

The postaccretion units consist of unconformably overlying, flat-lying Aptian mudstone, siltstone, sandstone, silicic tuff, and coal, and Upper Cretaceous dacite. Jurassic overlap units were revealed by drilling (Fadeev and Novaya Sibir' Islands). Aeromagnetic data indicate abundant mafic and ultramafic plutonic rocks occur at depth. The southwest boundary of the terrane is drawn along a linear positive gravity anomaly (between the

Kotel'nyi and Stolbovoy Islands) (L.A. Savostin, written commun., 1992). The eastern boundary of the terrane is defined from geophysical data that imply a thick (3 to 5 km thick) late Paleozoic and Mesozoic sequence of clastic deposits. **REFERENCES**: Zhizhina, 1959; Volnov and others, 1970; Churkin, 1973; Vinogradov and others, 1974; Volnov, 1975; Kos'ko, 1977; Avetisov, 1982; Kos'ko and others, 1990; Fujita and Cook, 1990

KUK **Kuril-Kamchatka terrane (accretionary wedge and subduction zone - predominantly turbidites) (East of Kamchatka Peninsula and Kuril Islands)**—Consists chiefly of two major units. (1) A structurally lower unit is composed of bedded turbidites of Quaternary to Pliocene age and underlying oceanic crust. The turbidites range generally from about 100 to 500 m thick, but range up to 1,000 m thick near the junction of the Kuril-Kamchatka and Aleutian trenches. Seismic-reflection surveys indicate the turbidites unconformably overlie oceanic crust. The turbidites are folded and deformed near the continental slope, and can be traced below the accretionary wedge unit at an angle of 5 to 15°. (2) A structurally upper unit consists of accretionary wedge deposits that occur in a series of overthrusts that enclose fragments of the deformed bedded turbidites. Rocks dredged from the accretionary deposits consist of turbidites that contain Pliocene diatoms, Upper Cretaceous oceanic chert that contains radiolarians, and basalt. And (3) as determined from seismic-reflection surveys, an older, structurally higher part of the accretionary wedge consists of units bounded by numerous thrust faults. Rocks dredged from that part of the trench slope consist of turbidites that contain Miocene to Pliocene diatoms, and volcanic rocks that are metamorphosed to greenschist facies. Locally along the northwestern margin, this older part of the accretionary wedge occurs in a depression up to 20 km wide and consists of well-stratified turbidite deposits that range from 1.5 to 2.5 km thick. Transverse canyons occur along the trench and are filled with Miocene to Quaternary turbidite deposits up to 3 km thick. **REFERENCES**: Gnibidenko and others, 1980; Valil'ev, 1982; Seliverstov, 1987; Lomtev and Patrikeev, 1989

KV **Kamyshovy terrane (island arc) (Sakhalin Island, Russian Southeast)**—Consists chiefly of: (1) oceanic basalt and chert with Upper Jurassic to Lower Cretaceous radiolarian; and (2) an overlying thick sequence of mid-Cretaceous basalt, andesite, argillite, sandstone, and conglomerate (Pobedinskaya sequence) that contain Albian to Cenomanian *Inoceramus*. **REFERENCES**: Geology of the U.S.S.R., Sakhalin Island, 1970; Simanenko, 1986

KY **Koyukuk terrane (island arc) (West-central Alaska)**—Occurs in the Yukon-Koyukuk basin and consists of northern and southern sequences. The northern sequence, north of Kaltag fault, consists chiefly of basalt, voluminous Lower Cretaceous (Neocomian) andesite flows, tuff, breccia, conglomerate, tuffaceous graywacke, mudstone, and bioclastic limestone with fossil and isotopic ages of Late Jurassic through Early Cretaceous (Berriassian to Aptian). The southern sequence, south of Kaltag fault, consists of: (1) Middle and Late Jurassic tonalite and trondhjemite plutonic rocks that locally intrude the Angayucham terrane which in this area may form the stratigraphic basement of the Koyukuk terrane; and (2) a sequence of Upper Jurassic to Lower Cretaceous volcanic and related rocks that are associated with and unconformably overlie the tonalite and trondhjemite. The volcanic and plutonic rocks of the terrane constitute the Middle Jurassic to Early Cretaceous Koyukuk arc.

For paleomagnetic determinations, grade A data from a series of various localities of Lower Cretaceous island arc volcanic and volcanogenic sedimentary rocks yield a $16^{o} \pm 8^{o}$ southerly displacement with respect to North America. The Koyukuk terrane is depositionally overlain by the Lower Cretaceous marine sedimentary rocks (unit Ks) of the Yukon-Koyukuk basin and by volcanic rocks of the Yukon-Kanuti igneous belt (part of the Kuskokwim Mountains sedimentary, volcanic, and plutonic belt, unit km). The Koyukuk terrane is generally structurally underlain by the Angayucham terrane. The Koyukuk terrane and the nearby Nyac and Togiak terranes are interpreted as a group of broadly coeval Jurassic and Early Cretaceous island arc terranes. **REFERENCES**: Patton, 1973; Hillhouse and Gromme, 1988; Box and Patton, 1989; Patton, 1991; Patton and others, 1994

LD **Laoelin-Grodekovsk terrane (island arc) (Southwestern part of Russian Southeast)**—Consists chiefly of three units. (1) A lower tectonic melange unit is composed of fragments of Lower Silurian granite-pebble-bearing conglomerate, sandstone, siliceous mudstone and lesser interbedded basalt, andesite, rhyolite, and tuff. The sedimentary rocks locally contain brachiopods and graptolites and are locally intensely deformed and metamorphosed to middle amphibolite facies. The structural thickness of the melange unit is about 1,500 m. And (2) an upper unit is composed of Permian basalt, andesite, rhyolite, conglomerate, sandstone, mudstone, and shale and lesser interbedded limestone lenses that contain Upper Permian Tethyan fusulinids. The structural thickness is about several thousand meters. The Permian rocks are intruded by zoned dunite-clinopyroxenite-gabbro intrusions that form Alaskan-type plutons, and local tonalite and plagiogranite. The Permian igneous rocks are interpreted as part of a Permian volcanic arc. Younger, collision-related, Late Permian granitic plutons intrude the terrane and are co-magmatic with Permian volcanic rocks in the Khanka superterrane. This relation suggests that accretion of the Laoelin-Grodekovsk terrane and Khanka superterrane occurred at the end of the Paleozoic. The Laoelin-Grodekovsk terrane is overlapped by: (1) Triassic plant-bearing conglomerate and sandstone; and (2) to the west in China by Upper Triassic continental rhyolite, Upper Jurassic rhyolite, and Late Jurassic subduction-related granitic plutons. **REFERENCES**: Evlanov, 1971; Shcheka and others, 1973; Nazarenko and Bazhanov, 1986; Izosov and others, 1988; Khanchuk and others, 1988

LG **Livengood terrane (oceanic crust) (East-central Alaska)**—Consists chiefly of a structurally deformed and poorly exposed assemblage of: (1) serpentinized harzburgite, minor dunite, and Cambrian diabase, gabbro, and diorite; (2) Ordovician black ribbon chert with graptolitic shale (Livengood Dome Chert); (3) poorly dated Silurian(?) or Upper Proterozoic(?) silicified dolomite with lesser chert, limestone, argillite, basalt, and volcaniclastic rocks (Amy Creek and Lost Creek units); (4) Upper Silurian limestone debris flows interbedded within siliciclastic strata; and (5) unconformably overlying Middle Devonian turbidite deposits composed of conglomerate sandstone and mudstone with minor limestone (Cascaden Ridge unit). The conglomerate in the Cascaden Ridge unit contains clasts of mafic and ultramafic rocks. The terrane is one of several, narrow, east-northeast-trending terranes in the region. The terrane is faulted against the Crazy Mountains, Ruby, and Angayucham terranes to the northwest, and is thrust under the Manley terrane to southeast. The Livengood terrane is interpreted as a fragment of a Cambrian ophiolite or oceanic crust with overlying Cambrian to Silurian pelagic and continental rise and slope deposits and Devonian turbidite deposits. **REFERENCES**: Churkin and others, 1980; Weber and others, 1985; Jones and others, 1986; Loney and Himmelberg, 1988; Dover, 1990; Grantz and others, 1991; Blodgett 1992; Blodgett and others, 1988; Weber and others, 1992

LN **Lan terrane (turbidite basin) (Northern part of Russian Southeast)**—Consists chiefly of Middle Devonian, Carboniferous, Permian, and Triassic turbidite deposits with olistostrome horizons (Dzhegdalinsk, Ustarteksk, Arteksk, Torbosk, Alukansk, Lansk, and Deloesk suites). Inclusions in the olistostromes consist of mafic volcanic rocks, chert, and limestone. Major olistostrome units are: (1) a Middle Devonian olistostrome that contains limestone with Lower Cambrian archaeocyatheans of the North Asian platform affinity; (2) the Upper Carboniferous Alukansk suite that contains spilite, diabase, sandstones, and silicic volcanic rocks in which the absence of chert and the presence of silicic volcanic rocks suggest this thick sequence formed adjacent to a volcanic island arc; and (3) an Upper Triassic olistostrome that contains Triassic is exotic to the northern part of Russian Southeast. The Middle Devonian, Visean-Moscovian, and Upper Permian macrofossils of the terrane are a Boreal fauna. The Upper Permian unit of the Lan terrane with a Boreal fauna contrasts sharply with the Tukuringra-Dzhagdi terrane that has a Tethyan fauna. Overlapping the Lan terrane are Lower and Middle Jurassic shallow-marine clastic rocks and tuff that also overlap the Baladek terrane. Regional tectonic analysis suggests that these Jurassic deposits formed in the forearc basin of the Uda volcanic-plutonic belt (unit ud), part of the Mongol-Okhotsk active continental margin that occurs along the Stanovoy block of the North Asian craton. **REFERENCES**: Kirillova, Turbin, 1979, Brudnitskaya, 1990

LO **Lomonosov terrane (passive continental margin) (Cenozoic) (Arctic Ocean)**—Located in the vicinity of the North Pole and consists of a steep-sided, flat-topped ridge of continental crustal rocks (as determined from interpretation of bathymetric, gravity, and seismic-refraction data) that rise to within 955 m of the sea surface. Seismic-refraction data and gravity modeling suggest the ridge has a crustal root that extends 28 km below sea level. The terrane consists of: (1) a lower unit that is about 23 km thick that has an average compressional wave velocity of 6.6 km/s; and (2) an upper unit that is about 5 km thick and has an average compressional wave velocity of 4.7 km/s. A seismic-reflection profile across this area shows a sedimentary rock unit of 0 to about 100 m thickness that drapes the underlying rocks of higher acoustic impedance. The velocity structure of the ridge closely resembles that of the outer shelf of the Kara Sea, supporting the interpretation of Wilson (1993) that the Lomonosov terrane is a displaced fragment of the outer Kara and Barents continental shelves. The terrane likely formed during rifting along the Arctic Midocean (Gakkel) Ridge that occurred between the Lomonosov Ridge and the outer Barents shelf at about 58 Ma between the times of anomalies 25 and 24B. **REFERENCES**: Wilson, 1963; Karasik, 1968: Kristoffersen, 1990; Weber and Sweeney, 1990

MA **Manley terrane (turbidite basin) (East-central Alaska)**—Comprises three distinct flysch sequences: (1) unfossiliferous Upper Triassic or Upper Jurassic, carbonaceous slate, argillite, phyllite, with sparse chert- and quartzite-pebble conglomerate, and minor chert that are intruded by gabbro (Vrain unit); (2) Upper Jurassic to Lower Cretaceous quartzite and pebble conglomerate (Wolverine unit); and (3) Albian and Upper Cretaceous shale, siltstone, graywacke, and polymictic conglomerate (Wilber Creek unit) that were probably derived from a magmatic arc and from sedimentary and volcanic rocks of the White Mountains and Livengood terranes. Intruded by mid-Cretaceous granitic rocks. The Manley terrane structurally overlies the Livengood terrane and is structurally overlain by White Mountains terrane. The Manley terrane is interpreted as a displaced fragment of a Mesozoic overlap assemblage that was possibly originally deposited on the Livengood terrane, and possibly an offset equivalent of the Kandik River overlap assemblage (unit kn). **REFERENCES**: Jones and others, 1981, 1986; Weber and others, 1985, 1988; Gergen and others, 1988; Dover, 1990; Grantz and others, 1991

MAI **Mainitskiy terrane (island arc) (Northeastern part of Russian Northeast)**—Commonly contains an older and a younger sequence. The older sequence consists of: (1) a lower unit of serpentinite and serpentinite melange that contain fragments of late Paleozoic and early Mesozoic ophiolites, and limestone with spilite and bedded jasper which contain Middle and Upper Jurassic radiolarians; and (2) an upper unit of graywacke, siltstone, tuff, bedded chert that contain rare Berriasian and Valanginian *Buchia*. Local olistoliths are common and are composed of ophiolite, limestone with Permian and Triassic foraminifera, plagiogranite, andesite, and rhyolite that are all metamorphosed to pumpellyite facies. One of largest olistoliths of tuff and flysch contains chert with Upper Triassic radiolarians. The younger sequence consists of a thick assemblage of Upper Jurassic and Lower Cretaceous island arc volcanic and sedimentary rocks composed of tholeiitic basalt, andesitic basalt, rhyolite, tuff, breccia, chert, siltstone, and sandstone that contain Callovian to Kimmeridgian, and Tithonian to Hauterivian radiolarians. The younger sequence is interpreted as a late Paleozoic oceanic crust sequence that is overlain by a Mesozoic primitive island arc sequence.

The Mainitskiy terrane also contains a complex series large tectonically imbricated nappes. (1) In the central part of the terrane is a tectonically disrupted ophiolite (Yagel melange) of Late Jurassic to Early Cretaceous (Callovian to Hauterivian) age that consists of large blocks of dunite, peridotite, gabbro, and diabase dikes, and pillow-basalt with hyaloclastite and chert in a serpentinite matrix. Also occurring in the melange are dikes and lava flows similar to oceanic tholeiite, and younger island arc volcanic rocks. (2) In the northern part of terrane are several tectonic sheets of dunite, harzburgite, gabbro, and ultramafic rocks that are structurally overlain by island arc volcanic rocks. (3) In the southern part of terrane is an assemblage of Upper Jurassic and Lower Cretaceous (Neocomian) tuff and graywacke and exotic blocks of Paleozoic and early Mesozoic sedimentary and igneous rocks.

For paleomagnetic determinations, sedimentary and volcanic rocks of Upper Jurassic to Lower Cretaceous age yield grade A data indicating a southerly displacement with respect to the Siberian platform of $50^{o}\pm16^{o}$. The Mainitskiy terrane is interpreted as a fragment of a Late Jurassic up to Middle Cretaceous island arc that is underlain by a basement of oceanic crust and primitive island arc rocks of Triassic to Early Jurassic age. The various sequences forming the terrane were amalgamated in the mid-Cretaceous. The terrane is unconformably overlapped by the Cretaceous sedimentary rocks of the Kuibiveem sedimentary assemblage (unit kb **Kuibiveem sedimentary assemblage**). **REFERENCES**: Aleksandrov, 1978; Zinkevich, 1981; Pushcharovskiy and Til'man, 1982; Peyve, 1984, 1985; Byalobzhesky and others, 1986; Grigor'gev and others, 1987; Gel'man and others, 1988; Stavsky and others, 1989; Shmakin, 1991; Vishnevskaya and others, 1991; Sokolov, 1992; Didenko and others, 1993

MK **McKinley terrane (seamount) (Central Alaska Range, Alaska)**—Located between branches of the Denali fault. The terrane consists chiefly of a strongly folded and faulted structurally assemblage composed of: (1) fine-grained Permian flysch, mainly graywacke, argillite, and minor chert; (2) Triassic chert; (3) a thick sequence of Upper Triassic (Norian) pillow basalt; (4) Upper Jurassic(?) to Cretaceous flysch, mainly graywacke, argillite, minor conglomerate and chert; and (5) Late Jurassic(?) to Cretaceous gabbro and diabase. Also included in the terrane are Mississippian to Upper Triassic chert

(Red Paint subterrane) that is thrust over and infolded into the Jurassic to Cretaceous flysch. The McKinley terrane is interpreted as a fragment late Paleozoic deep-sea sedimentary rocks and one or more Upper Triassic seamounts and is one of several terranes that occurs in narrow tectonic lenses along the Denali fault. **REFERENCES**: Jones and others, 1981, 1982, 1987; Gilbert and others, 1984

MKR **Malokurilsk collage (Southeast of southern Kuril Islands)**—Consists chiefly of the Kamchatskiy Mys, Kronotskiy, Nemuro, and Stobolsky terranes. The collage also contains an assemblage of altered volcanic, granitic, and gabbroic rocks, quartz, schist, and siliceous shale that were dredged from uplifts of acoustic basement. The dredged rocks are interpreted as older than the pre-Late Cretaceous rocks within the terranes comprising the collage. It is not clear whether the dredged assemblage is the basement of the Nemuro island arc terrane or is a separate terrane. **REFERENCES**: Vasiliyev and others, 1979; Sergeev and Krasny, 1987

ML **Maclaren terrane (continental-margin arc) (Eastern Alaskan Range, Alaska)**—Located in a narrow east-striking lens between the Denali fault and the Broxson Gulch thrust. The terrane consists of the Maclaren Glacier metamorphic belt to the south and the East Susitna batholith to the north. The Maclaren Glacier metamorphic belt contains three fault-bounded sequences that consist of: (1) Upper Jurassic or older argillite, flysch, and sparse andesite and marble; (2) phyllite and metagraywacke; and (3) pelitic schist and amphibolite. The protolith for the Maclaren Glacier metamorphic belt may be the older part of the Kahiltna overlap assemblage (unit kh). The Maclaren terrane is progressively metamorphosed from lower greenschist facies to upper amphibolite facies. The higher metamorphic-grade units, which occur adjacent to the East Susitna batholith, structurally overlie lower grade units to south. The East Susitna batholith (unit TKpi) is mainly mid-Cretaceous to early Tertiary regionally metamorphosed and penetratively deformed granitic plutonic rocks. The Maclaren terrane also includes the Nenana terrane of Jones and others (1981, 1987). The Maclaren terrane is thrust over the Wrangellia superterrane to the south and interpreted as a offset fragment of Cretaceous continental-margin arc (Kluane Schist and Ruby Range batholith) formed in southeastern Alaska and southwestern Yukon Territory. **REFERENCES**: Smith, 1981; Nokleberg and others, 1985, 1989a, 1992, 1994a, b; Csejtey and others, 1986; Davidson and others, 1992

MM **Mamyn terrane (continental-margin arc) (Northwestern part of Russian Southeast)**—Consists chiefly of two major metamorphic units. (1) an older Early Archean(?) unit that is composed of garnet-cordierite-sillimanite gneiss and schist, granite-gneiss, gabbro, and amphibolite metamorphosed to granulite facies; and (2) an assumed younger sequence of Proterozoic(?) greenschist, metasandstone, marble, quartzite, felsite, sandstone, and siltstone. These metamorphic units are poorly exposed among the extensive Paleozoic granitic rocks of the Kiviliysk complex that have a minimum K-Ar isotopic age of 495 Ma. Overlying the metamorphic rocks of the terrane are younger overlap units: (1) Lower Cambrian limestone and dolomite with Archaeocyathids and Silurian clastic rocks (Mamynsk suite), and abundant quartz-rich sandstone and siltstone; (2) Middle Devonian siltstone, sandstone, and limestone (Oldoisk and Imchansk suites) that along with the Silurian units are gently folded; (3) Lower Cretaceous volcanic rocks (Peremykinsk and Taldansk suites) of the Umlekan-Ogodzhin volcanic-plutonic belt (unit uo), and (4) terrestrial clastic rocks of the Amur sedimentary basin (unit Czs). These overlap assemblages link together the Mamyn, Gonzha, Oldoi, and Turan terranes. **REFERENCES**: Shilo, 1982, Kozlovsky, 1988

MN **Minchumina terrane (passive continental margin) (Central Alaska)**—Consists chiefly of a complexly folded assemblage of: (1) Cambrian(?) limestone, dolomite, phyllite, and argillite; (2) Ordovician argillite, quartzite, grit, and chert; (3) Ordovician chert, argillite, shaley limestone, and siliceous siltstone; and (4) Middle to Upper Devonian limestone and dolomite. The Minchumina terrane is interpreted by Decker and others (1994), along with the Mystic, and Nixon Fork terranes, as part of the composite Farewell terrane. The Minchumina terrane is designated as a separate terrane by Patton and others (1994) and in this study, and is interpreted as a sequence of deep-water deposits that formed along a continental margin adjacent to the early Paleozoic platform carbonate rocks of the Nixon Fork terrane to west. Both terranes are interpreted as displaced fragments of the Paleozoic and early Mesozoic continental margin of North American. **REFERENCES**: Jones and others, 1981; Decker and others, 1994;Patton and others, 1994

MNK **Minook terrane (turbidite basin) (East-central Alaska)**—Consists chiefly of flysch composed conglomerate, sandstone, siltstone, and shale. The conglomerate contains mainly chert and lesser quartz, slate, and sandstone clasts in a sandy and locally calcareous matrix. The shale contains rare thin argillaceous sandstone and siltstone layers. The sedimentary rocks contain Lower Permian(?) megafossils. The terrane is moderately to intensely folded and occurs as an east-northeast-trending lens structurally adjacent to the Ruby, Livengood, and Manley terranes. The origin of the Minook terrane uncertain; it may be a fragment of the Nixon Fork, Angayucham, or Tozitna terranes. **REFERENCES**: Chapman and others, 1971; Jones and others, 1981; Dover, 1990; Grantz and others, 1991

MO **Monashee terrane (cratonal terrane) (Southeastern part of Canadian Cordillera)**—Consists chiefly of an isolated structural block that consists of: (1) granitic gneiss and heterogeneous supracrustal gneiss with isotopic ages of about 1.9 to 2.2 Ga (Parkinson, 1991; Armstrong and others, 1991) that seem to correlate with Early Proterozoic rocks underlying much of the northwestern part of the North American craton (Ross, 1991); and (2) structurally overlying quartzite, metapelite, calc-silicate schist, marble, minor amphibolite, and local alkalic orthogneiss, with an isotopic age of 740 Ma and metamorphosed to amphibolite facies. The structurally overlying rocks are interpreted by Scammell and Brown (1990) as having formed during Proterozoic and Early Cambrian magmatism and deposition that were the result of rifting of a Proterozoic supercontinent.

The Monashee terrane is mostly enclosed by the Kootenay terrane; the two are separated by Late Cretaceous and early Tertiary thrust faults (Monashee decollement) and Eocene extensional faults (Columbia River Fault). The faults are interpreted either as a crustal duplex that was uplifted during Mesozoic compression (Brown and others, 1986), or as a combination of Mesozoic compression and Tertiary extension (Monger and others, 1985). R.R. Parrish (personnel commun., 1991) suggests that the Monashee terrane may be the western extension of the Early Proterozoic shield that was partly modified during Phanerozoic deformation and was uplifted along Eocene extension faults. **REFERENCES:** Monger and others, 1985; Brown and others, 1986; Scammell and Brown; 1990; Armstrong and others, 1991; Parkinson, 1991; Ross, 1991

MT **Methow terrane (turbidite) (Southern Canadian Cordillera and northern U.S.A. Pacific Northwest)**—Consists chiefly of three different basinal, mainly units. (1) A basal Triassic MORB basalt unit (Spider Peak Formation) is associated with serpentinized ultramafic and gabbroic rocks of the Coquihalla serpentinite belt (Ray, 1986). (2) An overlying basalt unit composed of Jurassic (Sinemurian, Pliensbachian, Bajocian and Oxfordian?) pelitic rocks, siltstone, and tuff (Boston Bar Formation, Ladner Group) that laterally interfinger with (Aalenian-Bajocian) arc-related flows and volcaniclastic rocks (Dewdney Creek Formation, Ladner Group), and Upper Jurassic (Oxfordian to Tithonian) volcanic sandstone and argillite (Thunder Lake sequence; O'Brien, 1987; O'Brien and others, 1992). And (3) a thick (4500 m) upper unit is composed of Lower to early Upper Cretaceous (Hauterivian to Turonian) marine and nonmarine sequence of argillite, sandstone, and conglomerate (Jackass Mountain and Pasayten Groups of McGroder, 1991).

A granitic clast with a isotopic age of 235 Ma in the basal Ladner Group is interpreted as being derived from the Mount Lytton Complex in the Quesnellia terrane. An Upper Jurassic boulder in east-derived Albian conglomerate probably came from coeval granitic rocks in the western Quesnellia terrane. The west-derived chert-rich Albian to Cenomanian clastic rocks (Virginian Ridge Formation) are probably derived from the Bridge River terrane (Tennyson and Coles, 1978; O'Brien and others, 1992; Garver, 1992).

In the U.S.A. Pacific Northwest, the relatively unmetamorphosed clastic strata of the Methow terrane range in age from the Jurassic to the Late Cretaceous (Turonian) (McGroder, 1991). The clastic strata in this area are predominantly medium-grained marine sandstone and conglomeratic of early Upper Cretaceous age. These rocks interfinger with fluvial sandstone and conglomerate that was derived from the east, presumably from rocks of the Quesnellia terrane. **REFERENCES:** Ray, 1986; O'Brien, 1987; McGroder, 1991; O'Brien and others, 1992

MY **Mystic terrane (passive continental margin) (Central Alaska)**—Located mainly south of Denali fault. Consists of a complexly deformed but partly coherent, long-lived stratigraphic succession of: (1) Ordovician graptolitic shale and associated(?) pillow basalt; (2) Silurian massive limestone; (3) Upper Devonian sandstone, shale, conglomerate, and limestone that comprise the informally-named Yentna limestone of Fernette and Cleveland (1984); (4) uppermost Devonian to Pennsylvanian radiolarian chert; (5) Pennsylvanian siltstone, sandstone, and conglomerate; (6) Pennsylvanian(?) and Permian flysch, chert, argillite, and conglomerate (locally plant bearing); and (7) Triassic(?) pillow basalt and gabbro.

The Mystic terrane is structurally, and possibly locally stratigraphically, underlain by rocks of Dillinger terrane. Pre-Devonian rocks assigned in part to Dillinger terrane (Gilbert and Bundtzen, 1984; Blodgett and Gilbert, 1992). Mystic terrane interpreted by Decker and others (1994), along with Dillinger, Minchumina, and Nixon Fork terranes, as part of the composite Farewell terrane. Mystic terrane interpreted as a displaced fragment of the Paleozoic and early Mesozoic continental margin of North America. **REFERENCES**: Reed and Nelson, 1980; Gilbert and Bundtzen, 1984; Blodgett and Gilbert, 1992; Decker and others, 1994

NA **Nason terrane (accretionary wedge - predominantly turbidites?) (North-central part of U.S.A. Pacific Northwest)**—Consists chiefly of biotite schist (Chiwaukum Schist) and various gneiss bodies, and minor hornblende schist and amphibolite. Protolith age of the schist is uncertain but probably is pre-Late Jurassic (Tabor and others, in press). Based on Rb-Sr studies (Magloughlin, 1986), the protolith may be Late Triassic and may be correlative with the Settler Schist in British Columbia. Monger (1991a) correlated the Settler and Chiwaukum Schists with the Darrington Phyllite of the Easton terrane. On the index map of onshore terranes and overlap assemblages (Map A, Sheet 4), the Nason terrane is combined with the Bridge River terrane. **REFERENCES**: Magloughlin, 1986; Monger, 1991a

NAB **Nabilsky terrane (subduction zone - predominantly oceanic rocks) (Sakhalin Island)**—Consists chiefly of a melange unit with a matrix of late Campanian to early Paleogene(?) turbidites and Campanian chert olistostromes that enclose bodies of Upper Jurassic and Lower Cretaceous radiolarian chert and basalt, and guyot fragments. The guyots are capped by Upper Jurassic to Lower Cretaceous limestone that contains Tethyan reef corals. The melange also locally contains ophiolitic fragments, including large harzburgite and lherzolite bodies, and sparse cumulative gabbro and sheeted dikes. Geochemical data indicate both MORB and seamount basalt occurs in melange. In the southern part, the terrane also include one large allochthon (1.5 x 8 km) that is composed of medium-grade metamorphic rocks that yields K-Ar white mica ages of 130 to 148 Ma. The Nabilsky terrane is tectonically linked to the East-Sikhote-Alin volcanic-plutonic belt. **REFERENCES**: Rozhdestvensky, 1983; Raznitsin, 1982; Geology of the U.S.S.R., Sakhalin Island, 1970; Rikhter, 1986; Khanchuk and others, 1988

NE **Nemuro terrane (island arc) (Hokkaido Island, Japan, and Lesser Kuril Islands, Russian Southeast)**—Consists chiefly of the following two subterranes that are too small to depict on the map. (1) A northern subterrane consists of a monoclinal sequence of conglomerate, breccia, grit, sandstone, massive calc-alkalic pillow basalt, andesitic basalt, and basalt agglomerate and tuff. The basaltic rocks contain Campanian *Inoceramus* and a K-Ar age of 88 Ma. The basaltic rocks are unconformably overlain by tuffaceous flysch with layers of alkalic pillow basalt, diabase, and shoshonite sills that yield K-Ar ages of 65 to 89 Ma. and that contain Campanian to Maastrichtian *Inoceramus*. And (2) a southern subterrane consists of folded continental and shallow-marine lava, breccia, and andesite-basalt tuff, basalt, rare andesite that yields K-Ar ages of 69 to 82 Ma, and local layers of sandstone, grit, cherty siltstone with wood and plant detritus. The subterrane is intruded by local gabbro and sheeted dikes.

For paleomagnetic determinations, three localities of sedimentary and volcanic rocks of latest Cretaceous to Paleocene age are graded A, B, D, and yield southerly displacements of $14^o \pm 4^o$, $14^o \pm 7^o$ and $25^o \pm 20^o$, respectively. The grade A and D results are from sandstone and siltstone (Shikotan Island), and the grade B data are from andesitic rocks (Nemuro Peninsula). The Nemuro terrane is overlain by middle Miocene limestone with corals and pelycypods and by MORB-type basalt. The Nemuro terrane was originally interpreted as part of the Lesser Kuril island arc. **REFERENCES:** Yagi, 1969; Gavrilov and Solov'eva, 1973; Fujiwara and Otake, 1975; Kiminami, 1975, 1983; Melankholina, 1978; Parfenov and others, 1983; Grapes, 1986, Okada and others, 1989; Kato and others, 1990; Kononov and others, 1990; Goloionko, 1992; Bazhenov and Burtman, 1994

NR **Northwind Ridge terrane (passive continental margin) (late Early Cretaceous and Tertiary) (Arctic Ocean and Chukchi Sea)**—Seismic-reflection, gravity, and bathymetric data across a high-standing, flat-topped, steep-sided ridge (Northwind Ridge) near 74.5° and 75.5° N indicate a continental origin for the Northwind Ridge terrane. Along a seismic-reflection profile near 75.5° N, the ridge is interpreted as having a 0.5 to 2-km-thick cap of gently dipping sedimentary rocks that rest on acoustic basement. This basement exhibits northwest-trending magnetic anomalies of moderate amplitude, and may consist of volcanic, plutonic, or metamorphic rocks at moderate depth.

The gently-dipping sedimentary rocks are locally interpreted as eroded and offset by normal faults, suggesting that these rocks may be as old as Paleogene. Beneath the eastern half of the ridge, the gently dipping strata are underlain by 2 km or more of sedimentary strata which seem to contain numerous low-amplitude folds. Cores from low on the east flank of the ridge indicate that the sedimentary strata are dark gray prodelta shale with middle neritic to bathyal benthic foraminifers of Albian and possibly Late Cretaceous age (Phillips and others, 1992). The shale also contains reworked(?) dinoflagellates of Late Jurassic or Early Cretaceous age (D.J McIntyre, Geological Survey of Canada, written commun., 1991). The shale resembles the progradational Torok Formation of coastal Arctic Alaska, and on that basis, the Northwind Ridge terrane is inferred to be a displaced fragment of the Arctic continental margin. The inferred presence of a thick section of Cretaceous and Tertiary sedimentary rock beneath the seismic profile near 74.5° N is supported by aeromagnetic data which show that only low amplitude low-gradient magnetic anomalies underlie the ridge south of 75° N latitude **REFERENCES:** Hunkins and Tiemann, 1977; Grantz and others, 1992; Phillips and others, 1992

NS **Nora-Sukhotin terrane (island arc) (Western part of Russian Southeast)**—Located in a mostly concealed region beneath Cenozoic sedimentary rocks of the Amur-Zersk basin. Stratigraphic sequence reconstructed from isolated outcrops. Consists of two units: (1) mafic greenstone, mica schist, marble, metasandstone, and quartzite (Dagmarsk and Neklinsk suites) of presumed Late Proterozoic to early Paleozoic age, with greenschist-facies metamorphism; and (2) several sequences of Silurian through Lower Carboniferous andesite, sandstone, siltstone, greenschist, limestone, conglomerate, shale, and diabase that locally are variably metamorphosed to greenschist facies. The Upper Silurian through Lower Carboniferous units contain a marine fauna and an Angara flora. The terrane is unconformably overlapped by Permian sandstone, shale, conglomerate, tuff, and intermediate volcanic rocks that contain an Angara flora. The unconformity postdates the late Paleozoic amalgamation of the Nora-Sukhotin terrane with the Bureya superterrane. The Nora-Sukhotin terrane is interpreted as a middle Paleozoic island arc that formed on an older metamorphosed accretionary wedge complex. **REFERENCES**: Sorokin, 1972; Shilo, 1982; Martynyuk, 1983

NU **Nutesyn terrane (island arc) (Northern part of Russian Northeast)**—Consists chiefly of: (1) a basal unit of serpentinite and serpentinized peridotite and metagabbro; and (2) an upper unit of basalt, andesitic basalt, and andesite, tuff, hypabyssal dacite, rhyodacite bodies, volcaniclastic sandstone, conglomerate, and shale with a Upper Jurassic and Lower Neocomian faunas and Middle Jurassic flora imprints that are present in the upper unit. Basalt and limestone containing Lower Carboniferous corals are present at the base of the Upper Jurassic volcanic rocks. **REFERENCES**: Sizykh and others, 1977; Natal'in, 1984

NY **Nyac terrane (island arc) (Southwestern Alaska)**—Consists chiefly of andesite and basalt flows, breccia, tuff, and interbedded shallow-marine volcaniclastic rocks, with Middle and Upper Jurassic (Bajocian and Tithonian) fossils. The terrane is intruded by Early Cretaceous gabbroic and granitic rocks and depositionally overlain by Upper Cretaceous and early Tertiary volcanic rocks of the Kuskokwim Mountains sedimentary, volcanic, and plutonic belt (unit km). The Nyac and nearby Koyukuk and Togiak terranes are interpreted as a group of several broadly coeval Jurassic and Early Cretaceous island arc terranes. **REFERENCES**: Hoare and Coonrad, 1978; Box, 1985b, c; Box and others, 1993

NX **Nixon Fork terrane (passive continental margin) (Central and west-central Alaska)**—Present in several fault-bounded fragments. Consists of a long-lived stratigraphic succession composed in ascending order of: (1) Late Precambrian basement consisting mainly of pelitic and calcareous schist with minor marble, quartzite, and felsic metavolcanic rocks; (2) unmetamorphosed sedimentary rocks consisting of dolomite and laminated dolomitic mudstone; (3) unmetamorphosed sedimentary rocks of probable Upper Proterozoic age that consist of interbedded sandstone, siltstone, and carbonate rocks, and two dolostone units (Babcock and others, 1993); (4) Middle Cambrian limestone and chert; (5) Upper Cambrian to Lower Ordovician platy limestone (possibly part lower part of Novi Mountain Formation); (6) Lower Ordovician thick and platy limestone (Novi Mountain Formation); (7) Ordovician to Middle Devonian carbonate-platform rocks (Telsitna, Paradise Fork, and Whirlwind Creek Formations, and Cheeneetnuk Limestone (R.B. Blodgett, written commun., 1993); and (7) Permian, Triassic, and Cretaceous fossiliferous sedimentary rocks, mainly calcareous sandstone, siltstone, conglomerate, and sparse chert. Proterozoic stratified rocks intruded by Middle Proterozoic metagranitic rocks that yield a U-Pb zircon age of 1.27 Ga, and capped by Late Proterozoic metavolcanic rocks that yield a U-Pb zircon age of 850 Ma. Middle Paleozoic strata grade laterally into deep-water strata equivalent to the Dillinger terrane. The Permian strata contain clasts of basement rocks.

For paleomagnetic determinations, two sedimentary rock localities ranging from Early through Late Ordovician age yield grade A results, indicating no displacement with respect to North America ($2^{o}\pm8^{o}$, $4^{o}\pm15^{o}$). The Nixon Fork terrane is stratigraphically overlain by unnamed Triassic and Lower Cretaceous clastic rocks and by the Cretaceous Kuskokwim Group (unit kw), and is locally structurally overlain by the Angayucham terrane. The Nixon Fork terrane is interpreted, along with the Dillinger, Minchumina, and Mystic terranes, by Decker and others (1994) as part of the larger composite Farewell terrane. The Nixon Fork terrane is designated by Patton and others (1994) and herein as a separate terrane and is interpreted as one of several displaced fragments of the Paleozoic and early Mesozoic continental margin of North America. **REFERENCES**: Patton and others, 1980, 1994, Blodgett and Gilbert, 1983; Plumley, 1984; Blodgett and Clough, 1985; Clough and Blodgett, 1985; Palmer and others, 1985; Babcock and Blodgett, 1992; Decker and others, 1994

OC **Olympic core terrane (accretionary wedge - predominantly turbidites) (Southern Canadian Cordillera and northern U.S.A. Pacific Northwest)**—Consists chiefly of broken formation and melange of marine clastic rocks (Needles-Graywolf, Grand Valley, Western Olympic, and Lithic assemblages) that form the core of the Olympic Mountains. The marine clastic rocks are poorly dated but are probably mostly late Eocene to Oligocene in age (Tabor and Cady, 1987a, b). Some imbricated Miocene rocks also occur (M.T. Brandon, written commun., 1993). The terrane includes the western Olympic assemblage of Tabor and Cady (1987a), part of which may correlate with part of the Yakutat terrane in southeastern Alaska (Heller and others, 1992). The Olympic Core terrane is interpreted as having been subducted under the Siletzia terrane along the Hurricane Ridge fault. Deep seismic-reflection studies on Vancouver Island suggest that the Olympic core terrane forms the lowest of several northeast-dipping thrust sheets that form the crust of Vancouver Island, above the presently subducting Juan de Fuca plate (Clowes and others, 1987). **REFERENCES:** Clowes and others, 1987; Tabor and Cady, 1987a, b; M.T. Brandon, written commun., 1993

OF **Olds Ferry terrane (island arc) (Southeastern part of U.S.A. Pacific Northwest)**—In ascending order consists chiefly of: (1) the Upper Triassic Huntington Formation that is composed of moderate-and high-K volcanic rocks and abundant volcaniclastic sedimentary rocks; (2) a Lower Jurassic limestone and conglomerate (Weatherby Formation) that are probable facies equivalents of rocks in the adjacent Izee terrane; and (3) Upper Triassic and Lower Jurassic volcanic-arc plutons (Huntington arc). The Huntington Formation contains *Halobia* and ammonites of Upper Triassic (late Karnian to middle Norian) age (Brooks, 1979). The Olds Ferry terrane, initially defined by Silberling and others (1984), was included as part of the volcanic arc terrane of Vallier and others (1977), the Juniper Mountain-Cuddy Mountains volcanic arc terrane of Brooks and Vallier (1978), and the Huntington arc terrane of Dickinson (1979). The Weatherby Formation of Brooks (1979) was included in the Olds Ferry terrane by Silberling and others (1984), but is herein and by Vallier (1995) considered as part of the Izee terrane. The Olds Ferry terrane is intruded by Late Jurassic to Early Cretaceous granitic plutons. For paleomagnetic determinations, data from flows in the Huntington Formation indicate an approximate 18° N (or S) paleolatitude, the same as data from the Middle and Upper Triassic volcanic rocks of the Wallowa terrane (Hillhouse and others, 1982). **REFERENCES:** Vallier and others; 1977, 1995; Brooks and Vallier, 1978; Brooks, 1979; Dickinson, 1979; Silberling and others, 1984

OIR **Omchogsk-Iruneisk collage (Sea of Okhotsk)**—Consists chiefly of the West Kamchatka terrane (Omgon and Ukelayat subterranes) and the Kamchatka-Koryak volcanic belt (kk); the West Kamchatka sedimentary basin (unit wk) and the Tinro basin (unit tn) overlie the collage.

OK **Okhotsk terrane (cratonal) (Southeastern part of Russian Northeast)**—Located adjacent to the southern termination of the North Asian craton margin (Verkhoyansk foldbelt, unit NSV), and in ascending order consists of a long-lived succession of units: (1) large blocks of Archean to Early Proterozoic gneiss and schist that yield a U-Pb age of 3.7 Ga; (2) Middle and Upper Proterozoic gently-dipping, shallow-marine clastic and carbonate rocks; (3) Lower Cambrian limestone, marl, and sandstone; (4) Lower Ordovician conglomerate, limestone, marl, and sandstone with macrofossils; (5) unconformably overlying Middle Devonian limestone, sandstone, shale, and conglomerate, and Upper Devonian rhyolite, ignimbrite, andesite, dacite, and tuff that are interlayered with nonmarine sandstone, siltstone, and conglomerate; and (6) mainly nonmarine, rarely marine, clastic rocks of Carboniferous, Permian, Late Triassic, and Early and Late Jurassic age. The ages are determined by rare macrofossils and flora. The terrane contains local facies changes and stratigraphic gaps, and unconformities occur at the base of the Upper Triassic and the Upper Jurassic units.

For paleomagnetic determinations, one grade B result from sedimentary rocks and stromatolitic limestone of Precambrian (Riphean) age yields a southerly displacement with respect to the Siberian platform of $41^{o}\pm6^{o}$. The Okhotsk terrane is mostly overlapped by Neocomian and Albian to Upper Cretaceous nonmarine volcanic rocks of the Uda volcanic-plutonic belt (unit ud) and the Okhotsk-Chukotka volcanic-plutonic belt (unit oc). The Okhotsk terrane is correlated with the Omolon terrane of the Kolyma-Omolon superterrane of the Russian Northeast, and with the Kilbuck-Idono terrane of Alaska. **REFERENCES**: Korol'kov and others, 1974; Vel'dyaksov and Umitbaev, 1976; Avchenko, 1977; Chikov, 1978; Verzkhovskaya and Krichevets, 1987; Pavlov, 1993

OKM **Okhotomorsk collage (Sea of Okhotsk)**—Geophysical data indicate the collage contains a distinct tectonic basement unit composed of continental crust that is overlain by large sedimentary basins. The continental crust is about 30 km thick, much thicker than on other terranes in the Sea of Okhotsk. Much of the continental crust is overlain by a thin (up to 1-km thick) sedimentary cover. In the western part of the collage, granodiorite, quartz diorite, granite, basalt, rhyolite, tuff, siltstone, argillite, metasedimentary rock, and greenschist were dredged from the basement unit. The volcanic rocks are calc-alkalic and are interpreted as an island arc. The K-Ar ages of intrusive rocks range from 80 to 95 Ma. In addition to the island arc assemblage, older units of Paleozoic and Precambrian age of various tectonic origins may be present in the basement. A sharp unconformity is present at the base of the sedimentary cover. Seismic-reflection indicate a Oligocene to Quaternary age for the sedimentary cover. Along the southern boundary of the collage is a chain of narrow, asymmetric grabens that are interpreted by some workers as the Central Okhotsk rift zone.

The Okhotomorsk collage is interpreted as a composite terrane that was accreted during the Late Cretaceous against the active Cretaceous margin to the west, marked by the Okhotsk-Chukotka volcanic-plutonic belt (unit oc). Subsequently, large sedimentary basins (North Okhotsk basin, unit no, and Tinro basin, unit tn) formed above the suture. The collision of the Okhotomorsk collage with the Sakhalin terrane to the east is interpreted to have occurred in the Cenozoic. The Deryugin basin (unit dr) overlies this suture. Subsequent collisional deformation continued until the Miocene. **REFERENCES**: Gnibidenko, 1976; Mavrinsky and others, 1979; Gnibidenko and Khvedchuk, 1984; Baboshina and others, 1984; Parfenov and Natal'in, 1985

Olyutorka-Kamchatka terrane (island arc) (Koryak Highlands and Kamchatka Peninsula)—Consists of a major sequence of late Mesozoic and early Cenozoic island arc volcanic and sedimentary rocks.

OKO **Olyutorka subterrane (island arc) (Koryak Highlands, northeastern Russian)**—Located in a large nappe obducted onto the Ukelayat subterrane (turbidite basin) of the West Kamchatka terrane (accretionary wedge). Consists of: (1) a lower part composed of volcanic and siliceous oceanic rocks (Albian to Campanian Vatyn series); and (2) an upper part of Maastrichtian to Paleocene volcanic and clastic island arc deposits (Achayvayam and Ivtiginskaya suites). The subterrane is locally intruded by zoned intrusives range from dunite to clinopyroxenite to gabbro.

For paleomagnetic determinations, eight major localities in basaltic and sedimentary rocks range in age from Lower Cretaceous to Oligocene, and yield data from grade C through A. One grade B locality of Upper Cretaceous age yields a southerly displacement of $39^{o}\pm11^{o}$; however all the other Paleocene and older localities yield southerly displacements of about 15^{o} to 20^{o}, with error ranges of about 10^{o} with respect to the Siberian platform. The two grade A localities of Eocene and Oligocene age yield no displacement relative to the Siberian Platform (about $5^{o}\pm6^{o}$). **REFERENCES**: Alekseev, 1982; Pushcharovskiy and Til'man, 1982; Kovaleva, 1985; Bogdanov and others, 1987; Kovalenko, 1992; Heiphitz and others, 1994a

OKV **Valaginskiy subterrane (island arc) (Eastern Kamchatka Peninsula)**—Consists chiefly of: (1) a local unit of serpentinite melange that is composed of blocks of mid-Cretaceous jasper, basalt, gabbro, and ultramafic rock; (2) late Campanian to early Maastrichtian island arc deposits (Hapitskiy complex) that are composed of basalt, andesite flows and tuff, tuffaceous siltstone, volcaniclastic sandstone, and tuffaceous jasper; and (3) Maastrichtian and Paleocene deposits that are composed mainly of tuffaceous, clastic, and volcaniclastic rocks. The terrane is exposed in folded nappes and thrust sheets. **REFERENCES**: Shapiro and others, 1976, 1984; Tsukanov and others, 1987, 1988, 1989; Zinkevich and others, 1988, 1989, 1990; Tsukanov, 1991; Zinkevich and Tsukanov, 1993; Zinkevich and others, 1993

OL **Oldoi terrane (passive continental margin) (Northwestern part of Russian Southeast)**—From base to top consists chiefly of: (1) Silurian quartzose sandstone, siltstone, conglomerate, and minor limestone and Lower Devonian siltstone, sandstone, and conglomerate (Bolsheneversk and Omutninsk suites); (2) Middle Devonian (Eifelian) limestone, sandstone, and siltstone (Imchansk suite); and (3) Middle to Upper Devonian (Givetian-Fransian) sandstone, siltstone, and limestone, Upper Devonian (Fransian-Famennian) siltstone, sandstone, and limestone, and Lower Carboniferous (Tournaisian-Visean) sandstone, siltstone, conglomerate, and limestone (Tiparinsk, Teplovsk, and Oedoisk suites). The Devonian deposits contain abundant macrofossils (brachiopods, corals, bryozoans). Lower Carboniferous brachiopods and bryozoans are Boreal. Silurian deposits are locally metamorphosed at lower greenschist facies. The middle Paleozoic deposits are intruded by granodiorite, granite, and diorite that yield K-Ar isotopic ages of 204 to 257 Ma. Unconformably overlap assemblages are: (1) the Jurassic and Lower Cretaceous Bureya sedimentary basin (unit bu) that formed after amalgamation of the Oldoi and Gonzha terranes; and (2) Lower Cretaceous intermediate and silicic volcanic rocks, flora-bearing nonmarine clastic rock, and coeval granite and granodiorite of the Umlekan-Ogodzhin volcanic-plutonic belt (unit uo). This belt also overlaps the Oldoi, Gonzha, Mamyn, and Turan terranes. **REFERENCES**: Krasny, 1966; 1973; Shilo, 1982

OS **Oshima terrane (accretionary wedge - predominantly oceanic rocks) (Hokkaido Island, Japan)**—Consists chiefly of flysch and melange. The melange is composed of blocks of basalt, limestone, chert, siliceous shale, and sandstone that occur in a shale matrix (Matsumae, Tamdrigawa, and Kamiiso Groups). Middle Carboniferous fusulinids are present in the limestone blocks, Carboniferous to Permian radiolarians are present in the chert blocks, Triassic conodonts and radiolarians are present in limestone and chert blocks, and Upper Jurassic to Lower Cretaceous radiolarians are present in chert and siliceous shale blocks. The blocks were mixed together during the Late Jurassic to the Early Cretaceous. The melange is overlain by Lower Cretaceous andesitic lava, tuff and volcaniclastic rocks (Kumaneshiri and Rebun Groups) and is intruded by Early Cretaceous granodiorite, quartz monzonite, quartz diorite, tonalite, and adamellite (Matsumae, Daisenbongatake, and Yarappu massifs) that yield K-Ar ages of 90 to 130 Ma, and a Rb-Sr age of 126 Ma. The Oshima terrane is correlated with the Taukha terrane to the northwest in the Russian Southeast. **REFERENCES**: Hasegawa and Suzuki, 1964; Yoshida and Aoki, 1972; Ishida and others, 1975; Minoura and Kato, 1978; Hata and Kakimi, 1979; Ishiga and Ishiyama, 1987; Kato and others, 1990

Penzhina-Anadyr' terrane (accretionary wedge or subduction zone - predominantly oceanic rocks) (Western part of Koryak Highlands, eastern Russian Northeast)—Forms a major Mesozoic unit of subducted ophiolites and related rocks, oceanic sedimentary rocks, and turbidite deposits.

PAB **Ust'belaya subterrane (accretionary wedge or subduction zone - predominantly oceanic rocks) (Western part of Koryak Highlands, eastern Russian Northeast)**—Forms northern part of the Penzhina-Anadyr' terrane. The subterrane consists of several tectonic sheets that are distinguished by contrasting lithologies. (1) The Otrozhnaya sheet is composed of an ophiolite that contains metamorphosed ultramafic rocks, gabbro, diabase, basalt, and volcanic breccia, and an overlying sequence of chert, calcareous sandstone, tuff, and limestone that yield Middle and Upper Devonian and Lower Carboniferous faunas. The Otrozhnaya sheet is intruded by diabase, plagiogranite, and diorite dikes that yield K-Ar ages of 180 to 304 Ma. (2) A sheet of serpentinite melange. (3) The Mavrina sheet is composed of shallow-marine sandstone and siltstone and interlayered conglomerate and limestone that yield a Middle Jurassic fauna. And (4) an uppermost sheet is composed of interlayered sandstone, siltstone, and mudstone that yield an Upper Jurassic to Lower Cretaceous fauna. **REFERENCES**: Aleksandrov, 1978; Pushcharovskiy and Til'man, 1982

PAG **Ganychalan subterrane (accretionary wedge or subduction zone - predominantly ocean rocks) (Western part of Koryak Highlands, eastern Russian Northeast)**—Consists chiefly of several tectonic sheets that are distinguished by contrasting lithologies. (1) The Il'peney suite composed of mafic MORB-type volcanic rocks (K-Ar isotopic ages of 320 and 350 Ma), and chert, and carbonate rocks that are metamorphosed to blueschist and greenschist facies. The mafic rocks of the suite include gabbro, gabbro-norite, troctolite, minor wehrlite, and lherzolite. The suite also includes local amphibolite, migmatite, and minor tonalite and gneiss-gabbro. A garnet-amphibolite yields an Pb/Pb isotopic age of 1100 Ma (G.E. Nekrasov, oral communication, 1992). The Il'peney suite also locally contains a local ophiolite assemblage composed of dunite, peridotite, gabbro, a mafic dike complex, and basalt (Ar-Ar isotopic ages of 530 to 560 Ma). (2) Ordovician limestone and chert. (3) Ordovician to Silurian conglomerate and shale. (4) Devonian limestone and basalt. (5) Sandstone, tuffaceous, and clastic deposits with thin basalt layers, and andesitic basalt that contain a Carboniferous to Permian fauna and flora. And (6) Upper Triassic tuffaceous and clastic deposits. The subterrane is unconformably overlain by Albian sedimentary rocks. **REFERENCES**: Dobretsov, 1978; Nekrasov, 1976; Pushcharovskiy and Til'man, 1982; Belyi and others, 1984; Khanchuk and others, 1992; Sokolov, 1992; Sokolov and others, 1994

PAM **Main subterrane (accretionary wedge or subduction zone - predominantly turbidites) (Western part of Koryak Highlands, eastern Russian Northeast)**—Located in isolated outcrops; a composite section consists of: (1) Ordovician to Silurian shale, calcareous sandstone, siltstone, and limestone (Pal'matkin River suite); (2) Lower Carboniferous volcanic and sedimentary island arc deposits including andesite, dacite, tuff, tuff breccia, and volcaniclastic rocks that are fossiliferous and contain an Angara flora; (3) Upper Permian clastic deposits that are interbedded with thin layers of limestone; (4) Upper Triassic to Middle Jurassic tuff, andesite tuff-breccia, tuffaceous sandstone, siltstone, and mudstone; and (5) Upper Jurassic to Lower Cretaceous sandstone, siltstone, and conglomerate that contain intraformational disconformities and stratigraphic gaps. The subterrane is overlain by the early Tertiary Kamchatka-Koryak volcanic belt (unit kk). **REFERENCES**: Pushcharovskiy and Tul'man, 1982; Kovaleva, 1985; Sokolov, 1988; Khanchuk and others, 1992; Sokolov and others, 1992

PC **Porcupine terrane (passive continental margin) (Northeastern Alaska and northwestern Yukon Territory)**—Consists chiefly of a long-lived stratigraphic succession that in ascending order is composed of: (1) Precambrian (Proterozoic?) phyllite, slate, quartzite, marble, and greenstone (metabasalt); (2) a thick structurally and stratigraphically complex assemblage of Cambrian(?) to Upper Devonian shallow-marine limestone, dolomite, minor chert, and minor shale (including Salmontrout Limestone); (3) late Paleozoic sandstone, siltstone, argillite, massive quartzite, conglomerate, and minor limestone; and (4) the Permian Step Conglomerate. Jurassic ammonite-bearing strata occur in two places in the northern part of the terrane. The terrane is depositionally overlain by the now-faulted Kandik River assemblage (unit kn), and is overlain by late Tertiary and Quaternary basalt (unit QTvm).

For paleomagnetic determinations, a series of unnamed (16 Ma) volcanic flows (unit QTvm) yield a close grouping of grade D magnetic vectors because of the absence of any stability test. This absence would normally lead to rejection, but the data are internally consistent and young, and are assumed to represent the ancient magnetic field. The data indicate zero displacement with respect to North America ($1^o \pm 3^o$). The Porcupine terrane is thrust over the Kandik River overlap assemblage (unit kn) to southeast, and is locally overthrust by the Angayucham terrane. The Porcupine terrane is interpreted as a displaced fragment of the Paleozoic and Mesozoic continental margin of North America. **REFERENCES**: Brosgé and Reiser, 1969; Imlay and Detterman, 1973; Lane and Ormistron, 1979; Howell and Wiley, 1987; Plumley and Vance, 1988; Howell and others, 1992

PGR **Pogranichny collage (Sea of Okhotsk)**—The Pogranichny collage is interpreted as an Upper Cretaceous and lower Cenozoic accretionary wedge that is mostly overlain by the large Deryugin sedimentary basin (unit dr). No data exist on the composition of the basement to the collage. Geophysical data indicate that the crustal thickness of the collage is thinner than in neighboring units. Formation of the Pogranichny collage is tectonically linked to the Cretaceous arc rocks of the Okhotomorsk collage to the east. **REFERENCE**: Baboshina and others, 1984

PK **Pekul'ney terrane (subduction zone - predominantly oceanic rocks) (Northeastern part of Russian Northeast)**—Located in a north-trending vertical tectonic zone. Divided into western and eastern units. The western unit consists of: (1) a basal serpentinite matrix melange that contains fragments of metamorphic rocks, including greenschist, glaucophane schist, and picritic basalt; (2) a metamorphic complex that is composed of amphibolite and schist that are derived from dunite, spinel peridotite, clinopyroxenite and that yields Pb-Pb isotopic ages of 1,600 to 1,800 Ma, and eclogite inclusions that yield isotopic ages of 2,400-1,900 Ma; and (3) the Upper Jurassic and Lower Cretaceous Pekulneyveem suite which is composed of basalt, tuff, hyaloclastite, radiolarian chert, siltstone, and sandstone. The basalt is part of a picritic diabase-basalt complex that includes dikes, small intrusive bodies, and veins of meymechite, and a Hauterivian volcanogenic sequence of tuff, agglomerate, siltstone, and shale. The eastern Televeem unit consists of thick flysch of Early Cretaceous (Aptian to Albian) and Upper Cretaceous (Cenomanian to Turonian) age. Overlying postaccretion units are Upper Cretaceous shallow-marine and nonmarine clastic sedimentary rocks and the mainly early Tertiary Kamchatka-Koryak volcanic belt (unit kk). The Pekul'ney terrane is interpreted as a subduction zone assemblage that was tectonically paired to the West Pekul'ney island arc terrane. **REFERENCES**: Markov and Nekrasov, 1979; Palandzhyan and others, 1982; Nekrasov and Sumin, 1987; Markovsky and Bogdanov, 1985; Zhulanova and Pertsev, 1988

PN **Pingston terrane (turbidite basin) (Central Alaska Range, Alaska)**—Exposed in discontinuous, narrow, fault-bounded lenses along the Denali fault. Chiefly a weakly metamorphosed, strongly folded and faulted sequence that in ascending order consists of: (1) Lower Pennsylvanian and Permian phyllite, minor marble, and chert; (2) Upper Triassic thin-bedded, laminated dark limestone, black sooty shale, calcareous siltstone, and minor quartzite; and (3) locally numerous bodies of post-Late Triassic gabbro, diabase, and diorite. The terrane contains a single slaty cleavage that parallels axial planes of locally abundant isoclinal folds. The terrane also occurs in a small lens of thin-bedded dark limestone, sooty shale, and minor quartzite in the eastern Alaska Range (W.J. Nokleberg and D.H. Richter, unpub. data, 1987). The widespread Late Triassic part of the terrane is interpreted as a turbidite-apron sequence that were derived from a cratonal source, such as the Yukon-Tanana terrane to the north, and were deposited on the late Paleozoic continental slope and rise. **REFERENCES**: Jones and others, 1981, 1982; Gilbert and others, 1984

PR **Pacific Rim terrane (accretionary wedge and subduction zone - predominantly turbidites) (Southwestern Canadian Cordillera and northwestern U.S.A. Pacific Northwest)**—On southwestern Vancouver Island, ascending order, consists of: (1) Upper Triassic to Lower Jurassic arc-related volcanic rocks; and (2) unconformably overlying, disrupted graywacke, argillite, conglomerate, chert, and tuff of mainly Late Jurassic (late Kimmeridgian and early Tithonian) to Early Cretaceous (mid-Valanginian) age (Muller, 1977; Brandon, 1989). The terrane is metamorphosed to prehnite-lawsonite facies. Seismic data indicate that the Pacific Rim terrane forms a northeast-dipping thrust sheet that is sandwiched between the overlying Wrangellia superterrane and the underlying Siletzia terrane (Clowes and others, 1987). The Pacific Rim terrane is bounded to the northeast by the Westcoast Fault that was the loci of major, pre-Eocene displacement. Brandon (1989) interprets the Pacific Rim terrane as an olistostrome melange produced by submarine-slumping that was deposited on an arc basement. He also concludes that the terrane was displaced in the latest Cretaceous to early Tertiary from a site in the western North Cascades.

In the U.S.A. Pacific Northwest, the Pacific Rim terrane consists of the western and eastern melange belts of Frizzell and others (1987), the Trafton melange of Whetten and others (1988), and the Helena-Haystack melange (Tabor and others, 1988, 1989) that forms the highly deformed eastern border of the terranes. The western melange belt consists mostly of highly disrupted Upper Jurassic to Lower Cretaceous marine clastic rocks of probable fan origin but also contains minor chert, greenstone, limestone, and metaplutonic rocks The eastern melange belt and Trafton melange contain abundant blocks of greenstone, chert, limestone, metaplutonic rocks, amphibolite gneiss, and scattered ultramafic rocks. The blocks range from Mississippian to Late Jurassic in age. The limestone is late Paleozoic.

In the San Juan Islands, the Pacific Rim terrane was named the Decatur terrane by Whetten and others (1988). These rocks consist mostly of Mesozoic marine sedimentary and volcanic rocks, and overlying ophiolitic rocks of the Jurassic Fidalgo Igneous Complex (Brandon and others, 1988). In the latest Cretaceous to earliest Tertiary, the western and eastern melange belts, and the Decatur terrane are interpreted as having been thrust to the northeast over the Grandy Ridge and other terranes, thereby producing the Helena-Haystack melange (Tabor and others, 1989; Tabor, 1994). **REFERENCES:** Muller, 1977; Rusmore and Cowan, 1985; Clowes and others, 1987; Frizzell and others, 1987; Brandon and others, 1988; Whetten and others, 1988; Brandon, 1989; Tabor and others, 1988, 1989; Tabor, 1994

PW **Prince William terrane (accretionary wedge - predominantly turbidites) (Coastal southern Alaska)**—Consists chiefly of a complexly folded and faulted, thick assemblage of graywacke, argillite, minor conglomerate, pillow basalt, basaltic tuff, sills, dikes, and mafic ultramafic rocks (Orca Group, Sitkalidak Formation, and Ghost Rocks Formation). Includes the Upper Cretaceous and early Tertiary Ghost Rocks terrane of Jones and others (1987). Contains rare mega- and microfossils of Paleocene and Eocene age. On Resurrection Peninsula and on Knight Island, the terrane contains a local ophiolite that is interpreted as slabs of oceanic basement.

The terrane is bounded to north by the Contact fault and the Chugach terrane, to the south by the Aleutian megathrust or a late Cenozoic accretionary prism, and to the east by the Yakutat terrane. In the central and western parts of Prince William Sound, large parts of the terrane lack fossil control on either side of the Contact fault. In this area, the Contact fault may be a gradational accretionary zone. Sandstone petrologic studies indicate a local gradational contact between the Prince William and Chugach terranes (Dumoulin, 1987, 1988). In the eastern part of Prince William Sound, east of Valdez and Cordova, the Orca Group of the Prince William terrane is singly deformed and is thrust under the doubly-deformed and metamorphosed rocks of the Valdez Group of the southern Chugach terrane (Plafker and others, 1989b).

One early Tertiary granitic pluton of the Sanak-Baranof plutonic belt (50-65 Ma) and local adjacent amphibolite facies metamorphism postdates accretion the northern Prince William terrane to the southern Chugach terrane. The Prince William terrane generally exhibits early Tertiary zeolite to greenschist facies metamorphism.

For paleomagnetic determinations, four of the five localities yield grade A results, the other a grade B result. The sampled rocks are mainly basalt, including pillow basalt, volcanogenic sedimentary rocks, and turbidite deposits. The age control is variable, either Early Tertiary or Paleocene. Four localities (three grade A and one grade B) indicate significant southerly displacement with respect to North America ($20^{o}\pm5^{o}$, $36^{o}\pm9^{o}$, $22^{o}\pm5^{o}$. $21^{o}\pm6^{o}$). One locality (Orca Group, Knight Island, grade A data) indicates zero displacement. The rotations of the paleomagnetic directions are not internally consistent between localities.

The Prince William terrane is overlain by assemblages of marine clastic rocks and local nonmarine coal-bearing rocks of post-middle Eocene age. The terrane is interpreted as a sequence of early Tertiary oceanic lithosphere, seamounts, and deep-sea fans that were tectonically imbricated into an extensive accretionary wedge complex. **REFERENCES**: Tysdal and Case, 1979; Moore and others, 1983; Plumley and others, 1983; Nelson and others, 1985; Dumoulin, 1987, 1988; Plafker and others, 1989b; Bole and others, 1992; Nelson, 1992; Bole, 1993

QN **Quesnellia terrane (island arc) (Central part of Canadian Cordillera)**—Consists chiefly mainly of west-facing Upper Triassic to Lower Jurassic (Karnian to Sinemurian) volcanic arc rocks (Nicola Group, Rossland Formation), coeval calc-alkalic and alkalic plutons, and laterally equivalent clastic sedimentary rocks (Mortimer, 1987; Monger, 1989; Andrew and others, 1990; Parrish and Monger, 1992). In southwestern British Columbia, volcanic arc rocks are unconformably overlain by clastic rocks of the Pliensbachian to Callovian Ashcroft Formation. The early Mesozoic volcanic arc rocks overlie at least two basement complexes (Monger and Berg, 1987). The basement complexes consist of the following: (1) Devonian through Permian chert, clastic rock, basalt, and ultramafic rocks of the oceanic Apex Mountain Complex; and (2) coeval volcaniclastic rocks, pelite, and carbonate of the arc-related Harper Ranch Group. These Paleozoic strata were deformed and juxtaposed with one another, and possibly with parts of the Kootenay terrane, prior to the Late Triassic (Read and Okulitch, 1979; Klepacki, 1983; Orchard and Danner, 1991). The two basement complexes may correlate with parts of the Slide Mountain terrane. In the Methow valley in the U.S.A. Pacific Northwest, the Quesnellia terrane also includes metasedimentary and metavolcanic rocks of unknown age.

Permian faunas in the Quesnellia terrane seem to be a mixture of mainly western Cordilleran forms similar to those in the Stikinia, Chilliwack River, and Slide Mountain terranes, with some Tethyan elements (Orchard and Danner, 1991). Lower Jurassic (Pliensbachian) faunas seem to be latitudinally comparable to those of the Stikinia terrane and formed south of their present position with respect to the North America craton (Smith and Tipper, 1986). Utilizing published paleomagnetic data, May and Butler (1986) conclude that no evidence for northward displacement is recorded in the Triassic and Jurassic rocks of the Quesnellia terrane. However for other paleomagnetic determinations, nine localities range in age from Miocene to Triassic, and in rock type from extrusive (three localities) to intrusive (three localities) rocks. The intrusive rocks are assigned to grade of C because of the problems inherent in determining the ancient horizontal. Two of the extrusive rock localities yield grade A data, and the third locality yields grade C data. The displacements with respect to North America for rocks of about 100 Ma and younger are zero, with southerly displacements of the order of 15^{o} to 20^{o} for rocks of Jurassic age, with the exception of the Guichon batholith which yields a zero displacement.

The Quesnellia terrane was thrust eastward and backfolded together with Slide Mountain terrane over the Kootenay terrane and adjacent continental margin rocks in the Early to Middle Jurassic (about 180 to 185 Ma), perhaps concomitantly with underthrusting of the Stikinia terrane beneath the Cache Creek terrane in northern British Columbia (Brown and others, 1986; Rickets and others, 1992). In turn, the Quesnellia terrane was overthrust from the west by the southern Cache Creek terrane, probably in the Late Jurassic. From regional stratigraphic relations and the low initial strontium ratios for magmatic rocks, the early Mesozoic part of the Quesnellia terrane is interpreted as an island arc that was active along the western margin of the North American continental margin. **REFERENCES:** Symons, 1969a, b, c, 1973c, 1985b; Read and Okulitch, 1979; Klepacki, 1983; Symons and Litalien, 1984; Brown and others, 1986; May and Butler, 1986; Smith and Tipper, 1986; Monger and Berg, 1987; Mortimer, 1987; Bardoux and Irving, 1989; Monger, 1989: Andrew and others, 1990; Irving and Archibald, 1990; Orchard and Danner, 1991; Parrish and Monger, 1992; Rickets and others, 1992

RB **Ruby terrane (metamorphosed continental margin) (Northern west-central Alaska)**—Consists chiefly of a structurally complex assemblage of quartz-mica schist, quartzite, calcareous schist, mafic greenschist (metabasalt), quartz-feldspar schist and gneiss, and marble. Sparse Silurian and Devonian fossils are present in metasedimentary rocks. Locally intruded by granitic gneiss that yields both Devonian and Early Cretaceous U-Pb zircon ages. Generally metamorphosed to greenschist facies and local amphibolite faces, with sparse relict blueschist facies metamorphic minerals. The Ruby terrane is overthrust by the Angayucham terrane, unconformably overlain by Lower Cretaceous sedimentary rocks of the Yukon-Koyukuk basin (unit Ks) and by the Cretaceous Kuskokwim Group (unit kw), and is extensively intruded by mid-Cretaceous granitic plutons. The Ruby terrane is interpreted as a highly metamorphosed and deformed, displaced fragment of the North American craton margin. **REFERENCES**: Patton and others, 1987, 1994

South **Anyui terrane (subduction zone - predominantly oceanic rocks) (Northern part of Russian Northeast)**—Located along an extensive linear fault zone (Lyakhov-South Anyui fault) between the Chukotka terrane to the north and the Kolyma-Omolon superterrane to the south. The continuation of the South Anyui terrane under the Cenozoic cover of the coastal region of the East Siberian Sea is based on magnetic and gravity anomalies. The exact location of the terrane, particularly northwest and southeast of Bol'shoi Lyakhov Island in the New Siberian Islands is uncertain. The South Anyui terrane may correlate with the Vel'may terrane to east, but tectonic reconstruction suggests that each formed in different areas. **REFERENCES**: Spektor and others, 1981; Natal'in, 1984; Parfenov, 1984; Savostin and Drachev, 1988; Dudko and Spektor, 1989; Drachev and Savostin, 1992

SAS **Shalaurov subterrane (subduction zone - predominantly oceanic rocks) (Northern part of Russian Northeast)**—Consists chiefly of tectonic sheets of serpentinized peridotite, MORB-type pillow lavas, and Permian to Triassic turbidite deposits. The basalts yield a Sm-Nd age of 291±62 Ma, and amphibole from amphibolite sheets has a K-Ar age of 473 Ma. All formations are cut by mid-Cretaceous granitic rocks of the anatectic Omineca-Selwyn plutonic belt (unit om) that yields K-Ar ages of 100 to 110 Ma. **REFERENCES**: Drachev, 1989; Drachev and Savostin, 1993

SAU **Uyamkanda subterrane (subduction zone - predominantly oceanic rocks) (Northern part of Russian Northeast)**—Consists chiefly of two major tectonic units. (1) A widespread sequence of highly deformed, MORB-type pillow basalt with graywacke, slate, and chert that contain Callovian-Oxfordian radiolarians and rare Upper Jurassic macrofossils. The sequence also contains local glaucophane schist, and dismembered ophiolite. And (2) turbidites that contain a rare Berriasian-Valanginian and Hauterivian macrofossils. The turbidites also locally contain conglomerate with coal lenses and wood remains. The subterrane is unconformably overlain by flat-lying Cretaceous nonmarine volcanic rocks and conglomerate of the Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Seslavinski, 1970, 1979; Dovgal' and Palymsky, 1972; Pinus and Sterligova, 1973; Sizykh and others, 1977; Natal'in, 1984; Lychagin and others, 1991

SB **Stolbovskoy terrane (island arc) (Northern Kamchatka Peninsula)**—Composed chiefly of slightly-deformed, volcanic, sedimentary, tuffaceous, and clastic deposits of Maastrichtian to Paleocene age. Basal part composed of tuffaceous deposits with chert layers that grade upward into clastic deposits that are rich in pyroclastic layers and mafic to intermediate flows (Stolboskaya series). Interpreted as an older volcanic arc, possible the obducted, older, western terminus of the Aleutian arc (Geist and others, 1991, 1994). **REFERENCES**: Borzunova and others, 1969; Khotin, 1976; Khubunaya, 1981; Shantser, 1987; Geist and others, 1991, 1994

SD **Seward terrane (metamorphosed continental margin) (Seward Peninsula, Alaska, and Chukotsk Peninsula, Northeastern Russian)**—On the Seward Peninsula, Alaska, the Seward terrane consists chiefly of a structurally complex assemblage of mica schist, micaceous calc-schist, metavolcanic rocks, and carbonate rocks. The two major units are the informally-named Nome and Kigluaik Groups. The Nome Group is composed of pelitic schist, marble, quartz-graphite schist, and mafic schist (rift-related metabasalt, calc-schist, and chlorite-albite schist). The metasedimentary rocks of Nome Group contain Cambrian through Silurian conodonts and megafossils. Part of group may be Proterozoic in age. Associated carbonate rocks, possibly part of Nome Group, occur in a poorly-exposed area in the eastern part of terrane and range in age from Early Cambrian to Middle Devonian. The terrane is regionally metamorphosed to blueschist facies, retrograded to greenschist facies, and penetratively deformed. The central part of the terrane consists mainly of the Kigluaik Group that contains: (1) an upper unit of pelitic and calcareous schist, marble, and lesser amphibolite and quartz-graphite schist that are metamorphosed at the upper amphibolite facies and are interpreted as a higher-grade counterpart of the Nome Group; and (2) a lower unit of marble gneiss, mixed gneiss, and gneissic granitic rocks, metamorphosed at the granulite facies, and locally intruded by large Cretaceous plutons. The Seward terrane includes a small pluton (the informally named Kiwalik Mountain orthogneiss of Till and Dumoulin, 1994) that yields a U-Pb zircon age of 381 Ma. The Seward terrane is correlated with the Coldfoot terrane to northeast, and is interpreted as a highly metamorphosed and deformed, displaced fragment of the North American continental margin. In northwestern Alaska, the Seward terrane is intruded by plutonic rocks of the Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Armstrong and others, 1986; Hudson, 1977; Patton and others, 1992; Till and Dumoulin, 1994.

On the Chukotsk Peninsula, Russian Northeast, the Seward terrane consists of seven sequences: (1) a metamorphic complex composed of gneiss, granite, migmatite, amphibolite, marble, and schist that yield a K-Ar isotopic age of 1,600 Ma and a Rb-Sr age of 1,990 Ma; (2) unconformably overlying quartzite, limestone, and mica schist of presumed Late Proterozoic age (Kelkhin series); (3) Upper Ordovician coral-reef limestone; (4) Silurian bituminous shale, limestone with graptolites, and dolomite; (5) Middle Devonian shallow-marine limestone; (6) Upper Devonian to Lower Carboniferous units which include shallow-marine sandstone and siltstone and stromatoporic limestone; and (7) local tectonic wedges of Lower and Middle Carboniferous shallow-marine limestone and clastic rocks. The terrane is intruded by granite that yields a Rb-Sr whole-rock age of 395±9 Ma. The terrane is regionally metamorphosed to greenschist facies and overlain and intruded by plutonic and volcanic rocks of the Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Obut, 1977; Shul'diner and Nedomolkin, 1976; Zagruzina, 1975; Nedomolkin, 1977; Natal'in, 1979; Markov and others, 1980; Zhulanova, 1990

SHL **Shelikovsk collage (Northwestern Sea of Okhotsk)**—Consists chiefly of the Kony Murgal terrane and overlapping island-arc volcanic rocks of the Uda volcanic-plutonic belt(unit ud).

SHT **Shmidt terrane (island arc) (Sakhalin Island, Russian Southeast)**—In ascending order, consists chiefly of three units. (1) A lower unit of serpentinite melange that is composed of harzburgite, cumulate gabbro, high-titanium dikes, basalt, and Upper Jurassic to Lower Cretaceous radiolarian chert (Tominskia sequence). The melange is interpreted as a subduction zone complex. (2) An intermediate unit that consists of bimodal sheeted dikes and flows, siliceous tuff that yield mid-Cretaceous (Albian to Cenomanian) radiolarians, and plagiogranite. The bimodal igneous rocks are geochemically similar to primitive island arcs. And (3) an upper unit that is composed of basalt, andesite, tuff, argillite, and sandstone that yield Cenomanian to Santonian *Inoceramus* (Slavyansk sequence). **REFERENCES**: Geology of the U.S.S.R., Sakhalin Island, 1970; Raznitsin, 1982; Yurkova, 1991

SM **Slide Mountain (accretionary wedge and subduction zone - predominantly oceanic rocks) (East-central part of Canadian Cordillera)**—Consists chiefly of Upper Devonian to Permian oceanic rocks, but also contains structurally intermixed subordinate volcanic arc rocks, granitic rocks, and minor continent-derived clastic rocks. Exposed in several areas, listed from north to south: Anvil Range, Sylvester, Nina Creek, Antler (Slide Mountain), Fennell, and Kaslo (Monger, 1977; Struik and Orchard, 1985; Nelson and Bradford, 1989; Richards and others, 1993). Substantial variation within terrane; two representative stratigraphic columns are depicted for the northern and central parts of the Canadian Cordillera.

In central and northern British Columbia, the Slide Mountain terrane consists of numerous fault-bound slices, each composed of one or several lithologies, including chert, pelitic rocks, basalt, diorite, gabbro, and ultramafic rocks, with minor volcanic arc and carbonate rocks (Struik and Orchard, 1985; Harms and others, 1988; Nelson and Bradford, 1989). Rarely, if at all, can the stratigraphy be correlated between tectonic slices. Permian and Devonian to Carboniferous granitic rocks (Mortensen, 1992b) locally cut bounding faults. Elsewhere, continent-derived clastic rocks, similar to parts of the Yukon-Tanana and Kootenay terranes are structurally imbricated within the Slide Mountain terrane. Middle Permian fusulinid faunas are comparable to those in the Quesnellia and other terranes in the conterminous western U.S.A. (Ross, 1969). For paleomagnetic determinations, two separate sedimentary rock units of Pennsylvanian or Permian age both yield grade A results, and both indicate equatorial paleolatitudes. However, only the Sliding Mountain locality provided sufficient data to calculate a southerly displacement with respect to North America of $46^{o} \pm 4^{o}$ (Butler and others 1988). However, newer data from Lower Permian rocks in the Slide Mountain terrane in northern and central British Columbia suggest northward displacement of about 20° relative to the North American craton (Richards and others, 1993).

Parts of the Slide Mountain terrane were probably thrust over the early to middle Paleozoic units of the Kootenay terrane and the North American craton margin rocks to the east. But this thrusting was a late episode in a complex structural history. Parts of the Slide Mountain terrane were structurally imbricated with one another prior to the Late Triassic, as shown by the Permian granitic rocks that crosscut bounding faults. In addition, the early Mesozoic island arc Quesnellia terrane stratigraphically overlaps the late Paleozoic oceanic and volcanic arc rocks that are probably largely equivalent to the Slide Mountain terrane. These rocks are correlated with volcanic rocks in the younger part of the Kootenay terrane (Klepacki, 1983). Although the Slide Mountain terrane was an accretionary wedge and subduction zone complex in the late Paleozoic and early Mesozoic, by the Upper Triassic and Early Jurassic, it was the basement to a Triassic sedimentary basin located to the east of the west-facing Quesnellia arc. This basin contains the informal Triassic *black phyllite* unit of east-central British Columbia, and the Upper Triassic Slocan Group in southeastern British Columbia. This basin contains detritus derived from a volcanogenic western source and a cratonal eastern source. **REFERENCES:** Ross, 1969; Monger, 1977; Klepacki, 1983; Struik and Orchard, 1985; Butler and others 1988; Harms and others, 1988; Nelson and Bradford, 1989; Mortensen, 1992b; Richards and others, 1993

SMA **Samarka terrane (accretionary wedge - predominantly oceanic rocks) (Eastern part of Russian Southeast)**—Consists chiefly of a Middle and Upper Jurassic accretionary wedge complex that contains tectonic sheets and lenses, olistostromes, and melange inclusions that are composed of Carboniferous and Permian reef limestone, Upper Triassic pelagic limestone, and interlayered Upper Devonian, Carboniferous, Permian, and Triassic chert, Lower Jurassic siliceous shale, and Permian and Triassic clastic marine rocks. The age of the terrigenous matrix of the melange and olistostrome consists of Middle to Late Jurassic (Berriasian). Valanginian clastic marine rocks unconformably overlie the accretionary wedge complex and, in turn, are unconformably overlain by Albian clastic marine rocks. The Upper Cretaceous and Paleogene East Sikhote-Alin volcanic-plutonic belt (unit es) links together the Samarka, Taukha, Kiselevka-Manoma, and Amur River terranes. **REFERENCES**: Golozubov and Melnikov, 1986, Vrublevsky and others, 1988 , Khanchuk and others, 1988, Natal'in, 1991

SR **Sredinnyi-Kamchatka terrane (metamorphic) (Central Kamchatka Peninsula)**—Composed of several metamorphic sequences. The basal metamorphic sequence consists of: (1) pre-Cretaceous gneiss and plagiogneiss, lesser garnet amphibolite, and marble (Kolpakov suite), and minor granite; suite previously interpreted as Precambrian, but a Cretaceous age of metamorphism is suggest by a recent Rb-Sr age of 141 Ma; (2) overlying two-mica schist (Shikhtinskaya suite) that contains pebbles of underlying gneiss of the basal sequence; and (3) unconformably overlying amphibole, biotite-amphibole, clinopyroxene-amphibole schist and amphibolite (derived from ultramafic and mafic rocks) and local conglomerate layers (Andrianovskaya suite). Younger units of the terrane are: (1) metamorphosed sandstone and siltstone, rare mudstone, conglomerate, and grit (Kheivan suite); (2) overlying amphibole schist formed from ultramafic and mafic volcanic rocks and quartzite (Alistor suite); and (3) metamorphosed volcanic and sedimentary deposits with glaucophane of uncertain age (Kvakhon sequence). The terrane is unconformably overlain by: (1) Lower and Upper Cretaceous clastic deposits with a local conglomerate at the base (Barab and Kikhcin suites); and (2) early to late Cenozoic volcanic arc rocks of the Central Kamchatka and Kamchatka-Koryak volcanic belts (units ck, kk). **REFERENCES**: Watson and Fujita, 1985; Shul'diner and others, 1987; Shantser, 1987; Savostin and others, 1992

ST **Stikinia terrane (island arc) (Southeastern Alaska and west-central Canadian Cordillera)**—In ascending order consists chiefly of: (1) Lower Devonian, Mississippian, Upper Pennsylvanian, and Permian volcanic arc rocks (Stikine assemblage) that are interbedded with carbonate and fine-grained clastic rocks (Brown and others, 1991; (2) unconformably overlying Upper Triassic volcanic arc rocks and interfingering clastic rocks (Stuhini Formation and Takla Group), and coeval granitic rocks; and (3) unconformably overlying Lower Jurassic andesitic volcanic rocks and intercalated sedimentary rocks (Hazelton and Spatzizi Groups, and Takwahoni Formation) (Tipper and Richards, 1976; Monger, 1977; Anderson, 1989; Gabrielse, 1991). The basement of the Stikinia terrane is unknown, although it may be partly(?) underlain by cratonal margin strata of the Yukon-Tanana terrane (Gehrels and others, 1990; McClelland, 1992). Nd-isotopic studies from late Paleozoic through Jurassic units of the Stikinia terrane suggest a juvenile character (Sampson and others, 1989).

Permian faunas from the Stikinia terrane are similar to those of the Quesnellia and Chilliwack River terranes, and to the McCloud limestone in the eastern Klamath Mountains of northern California (Brown and others, 1991). Similar Lower Jurassic (Pliensbachian) faunas in the Stikinia and Quesnellia terranes and in Nevada suggest deposition at lower latitudes, but probably on the eastern side of the ancestral Pacific Ocean (Smith and Tipper, 1986). Paleomagnetic data for the Permian, Triassic, and Jurassic strata of the eastern Stikinia terrane, however, indicate only a slight northward to no latitudinal shift with respect to the North American craton (May and Butler, 1986; Irving and Monger, 1987). However for other paleomagnetic determinations, 10 localities have been sampled that range in age from Lower Permian (one locality) to mid-Cretaceous (one locality). Most of localities are Lower Jurassic and the major rock types include intrusive, volcanic, and sedimentary rocks. Only the Lower Permian and one of the Middle Jurassic localities yield grade A data, the remainder yield grade B and C data. The localities generally indicate paleolatitudes around 30^{o}. The displacements are all southerly with respect to North America, and have values ranging from near zero ($2^{o}\pm 11^{o}$, $3^{o}\pm 18^{o}$ and $4^{o}\pm 16^{o}$) to around 22^{o} ($15^{o}\pm 9^{o}$, $17^{o}\pm 12^{o}$, $10^{o}\pm 7^{o}$, $18^{o}\pm 6^{o}$.

In southern southeastern Alaska, the Stikinia terrane consists of: (1) a basal sequence composed of Upper Proterozoic(?), Devonian(?), Carboniferous, and Permian andesitic, basaltic, and minor rhyolitic volcanic and volcaniclastic rocks that are interbedded with marine limestone and clastic sedimentary rocks; and (2) Upper Triassic to Upper Jurassic marine sedimentary clastic rocks, minor limestone, and various volcanic rocks (Hazelton and Stuhini Formations of Souther, 1971 and Anderson, 1989), which are locally intruded by Late Triassic and Early Jurassic granitic rocks and by middle Tertiary intermediate plutonic rocks.

The Stikinia terrane is herein interpreted as occurring either structurally, or stratigraphically above the Yukon-Tanana terrane. With the structural interpretation, the Stikinia terrane is interpreted as a fragment of an extensive early Mesozoic island arc. **REFERENCES**: Monger and Ross, 1971; Tipper and Richards, 1976; Monger, 1977; Monger and Irving, 1980; Monger and others, 1982; Symons, 1983; May and Butler, 1986; Smith and Tipper, 1986; Irving and Monger, 1987; Monger and Berg, 1987; Wernicke and Klepacki, 1988; Anderson, 1989; Gehrels and others, 1990; Vandal and Palmer, 1990; Gabrielse, 1991; Bevier and Anderson, 1991; Brown and others, 1991; Gabrielse, 1991; Evenchick, 1991; McClelland, 1992; Nelson and Mihalynuk; 1993

ST(?) **Stikinia(?) terrane (island arc) (East-central Alaska)**—Consists chiefly of metasedimentary rocks that are intruded by large Late

Triassic to Early Jurassic granitic plutons of the Taylor Mountain batholith. Metasedimentary rocks are mainly biotite-hornblende gneiss, marble, amphibolite, quartzite, pelitic schist, quartz-feldspar schist, and metachert. The protoliths of the metasedimentary rocks are thought to have formed in an oceanic or marginal basin. The Stikinia(?) terrane was intensely deformed and metamorphosed to amphibolite and epidote-amphibolite facies at high temperatures and pressures (local kyanite) during the Early to Middle Jurassic. The Stikinia(?) terrane structurally overlies the Yukon-Tanana terrane and is structurally overlain by the Seventymile terrane. The Stikinia(?) terrane is herein interpreted as a fragment of an extensive early Mesozoic island arc. **REFERENCES**: Foster and others, 1987, 1994; Dusel-Bacon and Hansen, 1992

SU **Susitna terrane (seamount) (Southern Alaska)**—Consists chiefly of thick piles of pillow basalt, deep-marine tuffaceous sedimentary rocks, sandstone, and tuff. Upper Triassic (Norian) *Monotis subcircularis* and *Heterastridium* sp. are locally abundant in argillite interbedded with the volcanic rocks. The terrane forms a rootless nappe in the highly deformed Mesozoic flysch of the Kahiltna overlap assemblage. The upper contact of basalt with flysch originally may have been depositional, but relations are now obscured by subsequent shearing along the contact. The Susitna terrane is interpreted as a possible fragment of an oceanic seamount or as a fragment of the Peninsular terrane and may be possibly lithologically equivalent to the Cottonwood Bay or Chilikadrotna Greenstones. This Sutsitna terrane is interpreted as having been tectonically decoupled from its basement and faulted into the Kahiltna overlap assemblage of flysch during the mid- or Late Cretaceous. **REFERENCES**: Jones and others, 1980, 1982

SV **Seventymile terrane (subduction zone - predominantly oceanic rocks) (East-central Alaska)**—Exposed as scattered remnants of three highly-deformed and locally folded thrust sheets that structurally overlie the Yukon-Tanana and Stikinia(?) terranes.

The lower thrust sheet is composed chiefly of a structural melange of undated metasandstone, metagraywacke, metaconglomerate, and metaandesite. The lower thrust sheet was pervasively metamorphosed to lower greenschist facies in the Mesozoic, and is interpreted as a fragment of an island arc.

The middle thrust sheet is composed chiefly of a structural melange of pillow basalt, basalt, mafic tuff, chert, argillite, and limestone. The chert and limestone contain Mississippian, Permian, and Upper Triassic radiolarians and conodonts, and locally the limestone contains a sparse giant *Parafusulina* assemblage. This assemblage indicates tropical depositional (C.S. Stevens, written commun. to D.G. Howell, 1990) that also occurs in similar oceanic and ophiolite terranes in the Canadian Cordillera, Klamath Mountains, and northwest Mexico. The middle thrust sheet was pervasively metamorphosed to lower greenschist facies during the Mesozoic, rare glaucophane occurs in pillow basalt. The middle thrust sheet is interpreted as a subduction zone melange composed of late Paleozoic and early Mesozoic oceanic crust and seamounts.

The upper thrust sheet is composed chiefly of harzburgite and peridotite with minor clinopyroxenite, and gabbro, and diabase with a local amphibolite sole. The upper thrust sheet is interpreted as the possible roots to a Jurassic(?) island arc. **REFERENCES**: Keith and others, 1981; Foster and others, 1987, 1994

SW **Swakane terrane (cratonal) (Northern part of U.S.A. Pacific Northwest)**—Consists chiefly of the Swakane Biotite Gneiss. U-Pb zircon and Rb-Sr whole-rock isotopic studies suggest that the protolith of the Swakane was a Precambrian dacite volcanic rock (Mattinson, 1972; Tabor and others, 1987; R.B. Fleck, quoted in Tabor and others, in press). **REFERENCES:** Mattinson, 1972; Tabor and others, 1987; Tabor and others, in press

SY **Sorachi-Yezo terrane (turbidite basin) (Hokkaido Island, Japan)**—Consists chiefly of two units. (1) An ocean floor basement facies (Sorachi Group) that is composed mainly of basalt, chert, siliceous shale, shale, sandstone, and limestone. The basalt is more than 850 m thick and consists mainly of pillow lava with lesser hyaloclastite in the upper part. The chert is 100 to 400 m thick and contains Tithonian to Barremian radiolarians. The limestone contains Lower Cretaceous calcareous algae. The overlying siliceous shale and volcaniclastic sedimentary rocks comprise an upward coarsening sequence. And (2) an overlying forearc basin facies (Yezo and Hakobuchi Group) that is composed of (a) siltstone sandstone, conglomerate, and volcaniclastic rocks, a deep-marine turbidite facies (Lower to Middle part of Yezo Group), (b) shallow-marine siltstone and sandstone, locally containing orbitolinid limestone (upper part of Yezo Group), and (c) shallow marine sandstone and conglomerate (Hakobuchi Group) that contain ammonites, *Inoceramus*, planktonic and benthonic foraminiferas, and radiolarians that range in age from Aptian to Maastrichtian. The Sorachi-Yezo terrane is correlated with the West Sakhalin terrane on Sakhalin Island to the north. Both the Sorachi-Yezo turbidite and West Sakhalin basin terranes are interpreted as forearc basin units for the East-Sikhote-Alin volcanic-plutonic belt. **REFERENCES**: Okada, 1983; Kiminami and others, 1986; Kito and others, 1986; Kato and others, 1990

SZ **Siletzia terrane (accretionary wedge - predominantly oceanic rocks) (Western part of U.S.A. Pacific Northwest)**—Consists chiefly of basalt and greenstone of the early and middle Eocene Crescent and Metchosin Formations and the Siletz River Volcanics. The Siletzia terrane includes parts of the Crescent and Siletz terranes of Silberling and others (1987). The greenstone consists of metamorphosed tholeiitic pillow basalt, massive basalt, diabase, gabbro, tuff, and breccia. Intercalated with the greenstone are minor clastic rocks, ferruginous coccolithic limestone, and argillite. Total structural thickness of the terrane is over 16,000 km (Babcock and Engebretson, 1991). On the Olympic Peninsula, the greenstone and basalt sequence appears to be stratigraphically underlain by continent-derived graywacke, argillite and minor conglomerate (Tabor and Cady, 1978).

The origin of these rocks is controversial (Snavely and others, 1968; Cady, 1975; Glassley, 1974; Lyttle and Clarke, 1975; Mueller, 1980; and Wells and others, 1984). Many workers now interpret the thick sequences of basaltic rocks to have been rapidly erupted in a continental-margin rift basin between about 56 and 45 Ma (Wells and others, 1984; Babcock and Engebretson, 1991).

Deep seismic-reflection studies on Vancouver Island suggest that the Siletzia terrane was partly subducted beneath the Wrangellia superterrane (Clowes and others, 1987). The basaltic rocks are stratigraphically overlain by middle and late Eocene turbiditic sedimentary rocks of the Northern Olympic forearc basin. **REFERENCES:** Snavely and others, 1968, Glassley, 1974; Cady, 1975; Lyttle and Clarke, 1975; Tabor and Cady, 1978; Mueller, 1980; Wells and others, 1984; Clowes and others, 1987; Silberling and others, 1987; Babcock and Engebretson, 1991

TA **Taku terrane (island arc) (Eastern part of southeastern Alaska)**—Present along the west side of the Coast-North Cascade plutonic belt (unit cn) and consists of three units: (1) black and gray phyllite, tuffaceous mudstone, metabasalt, metarhyolite(?) tuff and breccia, and metavolcaniclastic graywacke of pre-Permian age; (2) pillow basalt, basalt breccia, and tuff, marble, black phyllite, and gray chert (Gastineau Group) that have a stratigraphic(?) thickness of about 3,000 m, and contain Permian macrofossils; and (3) marble, chert, gray mudstone and shale, massive basalt, and diabase sills (Perserverance Group) that have a stratigraphic(?) thickness of several thousand meters, and contain Middle and Upper Triassic macrofossils and conodonts. The Taku terrane is generally schistose and intensely deformed. Other parts of the Taku originally, originally defined by Berg and others (1978) and Monger and Berg (1986), are now interpreted either as part of the Wrangellia superterrane to the north, ·the Gravina-Nutzotin-Gambier belt (unit gg) to the west, or the Yukon-Tanana terrane to the east (Plafker and others, 1989a; Gehrels and others, 1992). The Taku terrane is interpreted as an volcanic island-arc terrane distinct from the island arc parts of the Wrangellia superterrane and the Stikinia terrane (Gehrels and others, 1992). **REFERENCES:** Berg and others, 1978; Monger and Berg, 1987; Rubin and Saleeby, 1991; Gehrels and others, 1992

TD **Tukuringra-Dzhagdi terrane (subduction zone - predominantly oceanic rocks) (Northern part of Russian Southeast)**—Consists chiefly of fault-bounded units of: (1) tectonic lenses or olistoliths of Upper Proterozoic limestone; (2) Silurian and Devonian mafic volcanic rocks and chert; (3) Upper Carboniferous sandstone, siltstone, shale, and turbidites (Dzheskogonsk and Nektersk suites); (4) Permian flysch, greenstone, chert, and limestone with Tethyan fusulinids (Bochagorsk suite); and (5) a narrow tectonic lens of ophiolite (Pikansk complex) along the southern margin of the terrane that consists of gabbro, amphibolite pyroxenite, serpentinite, and plagiogranite. The terrane is generally metamorphosed to schist and microquartzite at the greenschist facies. A sparse fauna that includes Lower to Middle Devonian corals and crinoids in limestone, and Giventian brachiopods in siltstone. Upper Permian Tethyan fusulinids that occur in the Bochagorsk suite indicate a sharp paleobiographical contrast with terranes to the south.

Relict glaucophane-schist facies metamorphism is present in the western part of the terrane that is intensely deformed, as in the Uniya-Bom terrane, with a penetrative stretching lineation that formed by ductile processes during strike-slip transport of the terrane. The Tukuringra-Dzhagdinsk terrane is overlain by the Upper Cretaceous and early Tertiary Khingan-Okhotsk volcanic-plutonic belt (unit ko).

The Tukuringra-Dzhagdinsk terrane is interpreted as tectonically linked to the Uda volcanic-plutonic belt (unit ud) (Mongol-Okhotsk active continental margin) that formed along the Stanovoy block of the North Asian Craton (unit NSS). **REFERENCES**: Kirillova, Tulbin, 1979; Natal'in and others, 1985, Kozlovsky, 1988

TG **Togiak terrane (island arc) (Southwestern Alaska)**—Consists chiefly of two major sequences: (1) an lower ophiolite sequence at the southwestern end of the terrane that consists of Upper Triassic midocean-ridge pillow basalt, diabase, gabbro, and ultramafic rocks; and (2) a coherent upper sequence of Lower Jurassic to Lower Cretaceous marine volcaniclastic sandstone, conglomerate, shale, tuffaceous chert, minor argillaceous limestone, and marine to nonmarine andesite and basalt flows and flow breccia, and tuff. For paleomagnetic determinations, latest Cretaceous (68 Ma) volcanic flows yield a grade A southerly displacement with respect to North America of $11^{o}\pm4^{o}$. The Togiak terrane is depositionally overlain by the Cretaceous marine sedimentary rocks of the Kuskokwim Group (unit kw), and by volcanic and plutonic rocks of the Kuskokwim Mountains sedimentary, volcanic, and plutonic belt (unit km). At the northeastern end, the Togiak terrane may depositionally overly the Tikchik terrane. The Togiak and nearby Koyukuk and Nyac terranes are interpreted as a group of broadly coeval Jurassic and Early Cretaceous island arc terranes. **REFERENCES**: Hoare and Coonrad, 1978; Box, 1985b, c; Coe and others, 1985; Box and others, 1993

TK **Tikchik terrane (island arc) (Southwestern Alaska)**—Consists chiefly of a structurally complex assemblage of andesite, dacite, and rhyolite, volcaniclastic rocks, chert, tuffaceous chert, chert-lithic sandstone, limestone, dolomite, and argillite that contain microfossils of pre-Late Devonian, Devonian, Mississippian, Permian, and Triassic age. For paleomagnetic determinations, extrusive volcanic rocks of Permian age yield a grade B southerly displacement with respect to North America of $6^{o}\pm4^{o}$. The Tikchik terrane is depositionally overlain by Cretaceous marine sedimentary rocks of the Kuskokwim Group (unit kw), and intruded by the Late Cretaceous to early Tertiary plutonic rocks of Kuskokwim Mountains sedimentary, volcanic, and plutonic belt. The Tikchik terrane interpreted as a possible depositional basement to the Togiak (island arc) terrane. **REFERENCES**: Hoare and Coonrad, 1978; Karl and Hoare, 1979; Hoare and Jones, 1981; Box, 1985b, c; Box and others, 1993

Talovskiy terrane (subduction zone - predominantly oceanic rocks) (Koryak Highlands, eastern Russian Northeast)—Consists of an accretionary wedge and subduction zone complex of Mesozoic turbidite deposits and Mesozoic and older ophiolite and related rocks.

TLA **Ainynskiy subterrane (accretionary wedge - predominantly turbidites) (Koryak Highlands, eastern Russian Northeast)**—Consists chiefly of flysch composed of sandstone, siltstone, volcanic rocks, and interbedded fine-grained volcaniclastic tuff (Ainyn suite) that contain Upper Jurassic to Lower Cretaceous (Volgian to Aptian) macrofossils. The terrane also contains local ophiolite fragments of Berriasian and Hauterivian age. The central and northern parts of terrane are composed of: (1) tectonic lenses of serpentinite, greenschist, and blueschist with Vendian that contain Cambrian microfossils and conodonts; (2) greenstone, jasper, and limestone that contain Silurian, Devonian, Carboniferous and Permian fauna; and (3) intermediate tuff, volcaniclastic sandstone, grit, and conglomerate that contain Norian fossils. The terrane is intensely deformed with appressed folds, thrusts, and duplex structures. The terrane is unconformably overlain by Albian-Cenomanian shallow marine deposits (Mametcha suite), and by early Tertiary Kamchatka-Koryak volcanic belt (unit kk). **REFERENCES**: Ivanov and Pokhialainen, 1973; Alekseev, 1982; Chekhov, 1982

TLK **Kuyul subterrane (accretionary wedge - predominantly oceanic rocks) (Koryak Highlands, eastern Russian Northeast)**—Consists chiefly of tectonic sheets composed of: (1) serpentinite melange with blocks of: (a) ultramafic rock, gabbro, plagiogranite, dike suites of oceanic and subduction zone origin, and amphibolite; (b) island arc volcanic and sedimentary deposits composed mainly of andesite, dacite, tuff; and glaucophane schist; and (c) forearc tuff and sedimentary rocks; (2) Gankuvayam ophiolite composed of harzburgite, gabbro, troctolite, wehrlite, plagiogranite, sheeted dikes, and pillow lava of Bathonian and Tithonian age; (3) Kingiveem complex composed of oceanic volcanic, siliceous, and carbonate rocks of Permian, Middle and Late Triassic, and Middle Jurassic age; and (4) the Kuyul subduction-zone melange composed of Upper Jurassic and Lower Cretaceous turbidite deposits that contain *Buchia* and Middle Jurassic radiolarian chert.

For paleomagnetic determinations, two localities yield grade C results. At one locality Upper

Cretaceous rocks indicate a southerly displacement of $9^{o}\pm21^{o}$, which allows this terrane to be in place with respect to the Siberian platform. The other Triassic and Jurassic locality yields a southerly displacement of $49^{o}\pm14^{o}$. The tectonic sheets comprising the Kuyul subterrane are unconformably overlain by Upper Albian shallow marine deposits (Mametcha series) and by the Upper Cretaceous and lower Tertiary Kamchatka-Koryak volcanic belt (unit kk). **REFERENCES**: Pechersky, 1970; Ivanov and Pokhialainen, 1973; Alekseev, 1982; Sokolov, 1990, 1992; Khanchuk and others, 1990; Vishnevskaya and others, 1992; Heiphitz and others, 1994b

TNB **Tokoro-Nabilsky collage (Southwestern Sea of Okhotsk)**—Consists chiefly of Tokoro ophiolite terrane and Nabilsky accretionary wedge terrane.

TO **Tokoro terrane (subduction zone - oceanic crust) (Hokkaido Island, Japan)**—Consists chiefly of two major units. (1) A lower unit that consists of ultramafic cumulate rocks, diabase, pillow basalt, trachyte, alkali rhyolite, basaltic hyaloclastite and other volcaniclastic rocks, chert, and limestone (Nikoro Group). Jurassic Stromatopora and Upper Cretaceous foraminiferas occur in limestone, and Upper Jurassic to Lower Cretaceous radiolarians occur in chert. The mafic to ultramafic igneous rocks are derived from alkali basalt magmas, and are metamorphosed at the zeolite, prehnite-pumpellyite, sodic pyroxene-chlorite, and pumpellyite-actinolite facies (high-pressure intermediate facies type). And (2) an unconformably overlying upper unit that consists of Upper Cretaceous to Paleogene sedimentary rocks (Saroma Group). **REFERENCES**: Kiminami and Kontani, 1983; Research Group of Tokoro Belt, 1984; Iwata and Tajika, 1986; Kontani and others, 1986; Sakakibara and others, 1986; Tajika, 1988; Kato and others, 1990

TR **Terpeniya terrane (island arc) (Sakhalin Island, Russian Southeast)**—Consists chiefly of a thick tectonic melange composed of deep-marine and terrestrial Santonian to Campanian volcanic and sedimentary rocks (Berozovskaya, Rakitinskaya, and Bogatinskaya sequences). Locally contains *Inoceramus* and radiolarians. Volcanic rocks consist of island-arc tholeiitic, calc-alkalic, and shoshonite rocks. Some basalts close in composition to oceanic basalt. Abundant peridotite-pyroxenite-gabbroic and gabbro-plagiogranite intrusions are interpreted as having formed in the magmatic chambers of the island arc. The terrane is structurally disrupted and strongly folded. **REFERENCES**: Grannik, 1978; Geology of the U.S.S.R.; Sakhalin Island, 1970; Khanchuk and others, 1988

TU **Taukha terrane (accretionary wedge . predominantly oceanic rocks) (Southeastern part of Russian Southeast)**—Consists chiefly of an Early Cretaceous accretionary complex composed of four main units. The two units that are depicted on the right side of the stratigraphic column are: (1) a western, structurally lower unit of oceanic basalt overlain by Callovian to Tithonian radiolarian chert, Berriasian siliceous mudstone, and Berriassian to Valanginian turbidite deposits, about 3,500 m thick, that contain ammonites and pelecypods; and (2) an eastern, structurally higher unit of turbidite and olistostrome deposits that contain abundant Valanginian to Hauterivian radiolaria and a Neocomian flora.

Two lesser fault-bounded units are depicted on the left side of the stratigraphic column. (1) Allochthonous inclusions of oceanic intraplate basalt and chert with limestone caps (paleoguyots) that range up to several thousand meters wide and up to 10 km long. The limestone caps locally contain abundant Tethyan foraminiferas, mollusks, and conodonts whereas the chert contains Late Devonian to Early Jurassic conodonts and radiolarians. And (2) Upper Triassic clastic rocks that contain abundant *Monotis* and *Halobia*. The Taukha terrane was intensely deformed in the middle Albian and is unconformably overlain by late Albian to Turonian andesite and volcaniclastic rocks (East Sikhote-Alin volcanic-plutonic belt, unit es) that contain local plant flora. This belt also overlaps other terranes of the southern Russian Far East. The Taukha terrane is correlated with the Oshima terrane to the east on Hokkaido Island. **REFERENCES**: Golozubov and Melnikov, 1986; Nazrenko and Bazhanov, 1986; Mikhailov and others, 1986, 1987, 1989; Khanchuk and others, 1988; Khanchuk and others, 1989; Rudenko and Panasenko, 1990; Natal'in, 1991; Golozubov and others, 1992; Kemkin and Khanchuk, 1993

UB **Uniya-Bom terrane (turbidite basin) (Northern part of Russian Southeast)**—Consists chiefly of a tectonic sheet that is composed of Upper Triassic to Lower Jurassic turbidite deposits and interbedded olistostromes (Amkansk, Kurnalsk, Melsk, and Muyakansk suites). Subdivided on sandstone-to-mudstone ratio and on occurrence of rare fauna of *Monotis* in the Melsk suite, and of crinoids in Kurnalsk suite. The Upper Triassic Muyakansk suite contains an olistostrome horizon up to 500 m thick. Some limestones lenses contain oncolites and catagraphite similar to those in upper Precambrian rocks of North Asian craton whereas the other limestone lenses contain Upper Permian bryozoa. Turbidite deposits contain lenses of greenstone and microquartzite typical of the Tukuringra-Dzhagdi terrane. Sandstone and conglomerate clasts in Uniya-Bom terrane were derived in part from North Asian craton. The Uniya-Bom terrane is intensively deformed and contains a penetrative stretching lineation that formed by ductile processes during strike-slip tectonic transport. The Uniya-Bom terrane is interpreted as a forearc basin that was tectonically linked to the Uda volcanic-plutonic belt (unit ud) (Mongol-Okhotsk active continental margin) along the Stanovoy block of the North Asian Craton (unit NSS). **REFERENCES**: Kirillova, Turbin, 1979, Natal'in and others, 1985

UL **Ulban terrane (accretionary wedge - predominantly turbidites) (Northeastern part of Russian Southeast)**—Consists chiefly of Lower and Middle Jurassic turbidite deposit, and unconformably overlying Callovian turbidite deposits. The turbidite deposits contain local tectonic lenses of oceanic crustal rocks which include chert, siliceous shale, and mafic volcanic rocks. Chert contains Middle Jurassic radiolarians. The Ulban terrane is interpreted as tectonically linked to the Uda volcanic-plutonic belt (unit ud) (Mongol-Okhotsk active continental margin) that formed along the Stanovoy block of the North Asian Craton (unit NSS). **REFERENCES**: Maibroda and Sharuyeva, 1979; Shilo, 1982; Natal'in, 1991

VE **Vel'may terrane (subduction zone - predominantly oceanic rocks) (Northeastern part of Russian Northeast)**—Consists chiefly of a suite of Mesozoic silicic volcanogenic rocks that are composed of metamorphosed basalt, tuff, chert, siliceous and argillaceous slate, graywacke, and tectonic blocks of serpentinized harzburgite, pyroxenite, gabbro, and plagiogranite. The suite locally contains late Norian pelecypods. The suite was previously assigned a Late Jurassic age by analogy with the South-Anyui terrane. The Vel'may terrane is tectonically overlain by Upper Jurassic to Lower Cretaceous conglomerate, sandstone, and shale. The Vel'may terrane may correlate with South Anyui terrane to west, but paleotectonic reconstruction suggests that the two terranes formed in different areas. The Vel'may terrane is overlapped by the Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Voevodin and others, 1978; Tynankergav and Bychkov, 1987

VL **Viliga terrane (passive continental margin) (East-Central part of Russian Northeast)**—Consists chiefly of a thick sequence of Carboniferous, Permian, Triassic, and Jurassic marine clastic rocks. The sequence ranges up to 10 km thick. Major units are: (1) Lower Carboniferous sandstone and interbedded conglomerate, mafic tuff, and basalt flows; (2) Upper Carboniferous to Permian sandy argillite, siltstone, sandstone, tuff, chert, basalt, and shale that gradationally overlie the older units; (3) Triassic shale, siltstone, intermediate tuff, and limestone; and (4) Jurassic argillite, siltstone, intermediate tuff, sandstone, conglomerate that contain brachiopods, gastropods, *Kolymia*, *Monotis*, *Belemnites*, and *Inoceramus*. The Jurassic units locally contain leaf imprints and fossilized tree trunks. The terrane is deformed into linear folds and domes with gently-dipping limbs. For paleomagnetic determinations, one locality of Cretaceous age yields grade C results, and indicates a northward displacement with respect to the Siberian platform of about $-18^{o}\pm10^{o}$. The other Middle Jurassic locality yields grade B results that indicate little displacement ($9^{o}\pm17^{o}$). The Jurassic rocks of the Viliga terrane are interpreted as a back-arc basin assemblage that was tectonically paired to the Kony-Murgal island arc terrane. **REFERENCES**: Pechersky, 1970; Epstein, 1977; Polubotko and others, 1977; Terekhov, 1979; Bychkov and Kiseleva, 1990

VT **Vetlovskiy terrane (accretionary wedge - predominantly oceanic rocks) (Eastern Kamchatka Peninsula)**—Occurs in thin thrust sheets that are composed mainly of volcanic and sedimentary rocks, deep-water chert, mudstone, and carbonate rocks, and midocean ridge basalt (Vetlovskiy complex). The volcanic and sedimentary rocks range from Maastrichtian to lower Eocene and are overlain by conglomerate, sandstone, and siltstone (Tushevskaya suite), and by the early Tertiary Kamchatka-Koryak volcanic belt (unit kk). For paleomagnetic determinations, one locality of Miocene age yields a grade D result for sedimentary and basaltic rocks, and indicates a southerly displacement with respect to the Siberian platform of $14^{o}\pm8^{o}$. The Vetlovskiy terrane is interpreted as an accretionary wedge assemblage was that tectonically paired to the Olyutorka-Kamchatka island arc terrane. **REFERENCES**: Khramov, 1971; Shantser, 1987; Tsukanov and others, 1988, 1989; Fedorchuk and others, 1990; Zinkevich and others, 1990; Tsukanov, 1991

WA **Wallowa terrane (island arc) (Southeastern part of U.S.A. Pacific Northwest)**—Consists chiefly of a Pennsylvanian to Upper Jurassic sequence of: (1) Pennsylvanian tuff and sandstone that are interpreted as part of an island arc terrane; (2) Seven Devils Group which is composed of a Lower Permian sequence of silicic volcaniclastic rocks (Hunsaker Creek and Windy Ridge Formations); (3) Permian through Upper Triassic (Karnian) volcanic and volcaniclastic sedimentary rocks (Wild Creek and Doyle Creek Formations) (Vallier, 1977); (4) abundant Middle and Upper Triassic (Ladinian and Karnian) island-arc tholeiites and associated rocks (Wild Sheep Creek and Doyle Creek Formations); (5) massive carbonate rocks and flysch of Late Triassic (Norian) and Early Jurassic age (Martin Bridge Limestone and Hurwal Formation, respectively); (5) unconformably overlying Coon Hollow Formation; (6) Middle and Upper Jurassic alluvial fan, braided stream, and marine sandstone sequences that compose fault-bounded inliers; and (7) Permian and Triassic plutonic rocks that locally form roots to coeval volcanic arcs. The terrane is intruded by Late Jurassic and Early Cretaceous plutons that also intrude the Baker, Izee, and Olds Ferry terranes.

Paleomagnetic studies of the Seven Devils Group indicate Lower Permian rocks formed at about 35° paleolatitude (Harbert and others, in press) whereas Middle and Upper Triassic rocks formed at about 18° N or S paleolatitude (Hillhouse and others, 1982). The Wallowa terrane was accreted to cratonal North America by about 120 Ma (Lund and Snee, 1988). The upper Paleozoic to lower Mesozoic stratigraphic succession of the Wallowa and Cadwallader terranes, and the Wrangellia superterrane are very similar (Jones and others, 1977) and paleomagnetic data on Triassic rocks of both the Wallowa terrane and the Wrangellia superterrane indicate a similar 18° N or S paleolatitude (Hillhouse and others, 1982).

The Triassic island arc tholeiite volcanic rocks in the Wallowa terrane (Vallier, 1995) differ from the Triassic back-arc tholeiite(?) volcanic rocks in the Wrangellia superterrane, indicating different eruptive environments. The Wrangellia superterrane and the Wallowa terrane are therefore interpreted as separate but correlative terranes (Vallier, 1995). The Wallowa terrane was initially defined by Silberling and others (1984); was called the volcanic arc terrane by Vallier and others (1977), the Wallowa Mountains-Seven Devils Mountains volcanic arc terrane by Brooks and Vallier (1978), and the Seven Devils terrane by Dickinson and Thayer (1978). **REFERENCES**: Jones and others, 1977; Vallier, 1977; Vallier and others, 1977; Brooks and Vallier, 1978; Dickinson and Thayer, 1978; Ma; Lund and Snee, 1988; Hillhouse and others, 1982; Harbert and others, in press; Vallier, 1995

West Kamchatka terrane (accretionary wedge - predominantly turbidites) (Koryak Highlands, Russian Northeast and Kamchatka Peninsula)—Consists chiefly of Jurassic and Cretaceous turbidites which formed in an accretionary wedge tectonic environment.

WKO **Omgon subterrane (accretionary wedge - predominantly turbidites) (Western Kamchatka Peninsula)**—Consists chiefly of intensely deformed pillow and massive basalt interlayered with siliceous, argillaceous, carbonate rocks, and tuff of Jurassic and Early Cretaceous age. Unconformably overlain by Hauterivian-Barremian interlayered shale, siltstone, and sandstone that grade upward into Lower to Upper Cretaceous turbidite deposits. The lower part of the clastic sequence locally contains conglomerate derived form metamorphic and volcanic source region. The Omogon subterrane is tectonically linked to the Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Shantser and others, 1985; Shantser, 1987; Bondarenko and Sokolkov, 1990

WKU **Ukelayat subterrane (accretionary wedge - predominantly turbidites) (Koryak Highlands, Russian Northeast)**—Consists chiefly of a very thick sequence of turbidite deposits of Late Cretaceous (Santonian to Maastrichtian) and early Paleogene age. Turbidite deposits are mainly graywacke, arkose, and lesser subarkose. Arkose deposited from contour currents. Local olistostrome layers. Local Campanian chert and alkali basalt. Subterrane contains ammonites, *Inoceramus*, brachiopods, radiolarians, and foraminiferas and is generally complexly folded and imbricately thrusted. The turbidite deposits were deposited in continental slope and rise environments. The Ukelayat subterrane of the West Kamchatka terrane is interpreted as an accretionary wedge assemblage that was tectonically linked to the manly early Tertiary Kamchatka-Koryak volcanic belt (unit kk). **REFERENCES**: Ermakov, 1975; Markevich, 1978; Sokolov, 1990, 1992

WM **White Mountains terrane (passive continental margin) (East-central Alaska)**—Consists chiefly of three units: (1) Ordovician phyllite, slate, chert, and limestone overlain by pillow basalt, basaltic aquagene tuff, mafic volcanic breccia (Fossil Creek Volcanics), and local volcaniclastic conglomerate that contain granitic clasts dated at 560 Ma; (2) Silurian limestone and dolomite (Tolovana Limestone); and (3) undated gray, vitreous quartzite with argillite layers and Mississippian diorite and gabbro sills (Globe quartzite unit of Weber and others, 1992). The terrane is moderately to intensely deformed into east-northeast-trending upright folds and parallel high-angle faults. The terrane is similar to upper part of Crazy Mountains terrane to north across Tintina fault. White Mountains terrane structurally overlies Manley terrane to northwest and structurally underlies Wickersham terrane to southeast. The White Mountains terrane is interpreted as a displaced fragment of the early Paleozoic continental margin of North America. **REFERENCES**: Churkin and others, 1982; Weber and others, 1985, 1988; Dover, 1990; Aleinikoff and Plafker, 1989; Grantz and others, 1991

WP **West Pekul'ney terrane (island arc) (Northeastern part of Russian Northeast)**—Present in a series of north-trending tectonic sheets that dips steeply to the west. Consists of western and eastern and lower tectonic sheets. Western tectonic sheet consists of several units. (1) Chiefly a thick, folded sequence of flows and volcaniclastic rocks of intermediate, mafic, and sparse felsic compositions, argillite, siltstone, sandstone, grit, and rarely limestone that contain *Buchia* of Berriasian and Valanginian age and *Aucelline* of Aptian to Albian age. (2) Hauterivian to Barremian olistostrome with gabbro, ultramafic rock, jasper, and basalt fragments. And (3) Early Cretaceous plagiogranite and gabbro. Eastern sheet consists of several units. (1) Chiefly amphibole-pyroxene schist and olivine gabbro that yield Pb-Pb isotopic ages of 1,200 to 2,900 Ma; (2) Layered gabbro, ranging from plagioclase ultramafic rocks to gabbro-anorthosite, and small blocks of mica-graphite schist. And (3) pyroxene-amphibole gabbro and amphibole microgabbro, intruded by tonalite, plagiogranite, and amphibole- and biotite-amphibole gabbro. The West Pekul'ney terrane is overlapped by the Cretaceous and Paleocene Okhotsk-Chukotka volcanic-plutonic belt (unit oc) and by the mainly early Tertiary Kamchatka-Koryak volcanic belt (unit kk). **REFERENCES**: Nekrasov and Sumin, 1987; Zhulanova and Pertsev, 1987

WR **Wrangellia superterrane (island arc) (Southern Alaska, southeastern Alaska, and western Canadian Cordillera)**—Consists chiefly of middle Paleozoic and older Alexander sequence, late Paleozoic and early Mesozoic Wrangellia sequence, and Jurassic Peninsular sequence. Overlain by younger Mesozoic and Cenozoic sedimentary and volcanic rock assemblages. Equivalent to the former combined Alexander, Peninsular, and Wrangellia terranes of Jones and others (1987) and Monger and others (1987). Corresponds to the Wrangellia composite terrane of Plafker and others (1989b), and Nokleberg and others (1994b). Chief differences between regions are notable contrasts in the relative abundances of coeval strata. Toward the west, the Alexander, Wrangellia, and Peninsular sequences are interpreted as successively higher levels of a structural-stratigraphic succession. The predominantly early and middle Paleozoic Alexander sequence, the oldest part of the succession, is exposed mainly to the east and southeast in southeastern Alaska; the late Paleozoic and early Mesozoic Wrangellia sequence, the middle part of the succession, is present mainly to the north and west in southern Alaska; and the lower and middle Mesozoic Peninsular sequence, the youngest part of the succession is present mainly to the west on the Alaska Peninsula. On complicated areas of the map, as in southeastern Alaska, WR used instead of longer WRA abbreviation. WR abbreviation also used where WRA and WRW sequences are present together in complicated areas.

Substantial tectonic shortening has affected within the Wrangellia superterrane (Plafker and others, 1989b; Nokleberg and others, 1994b). The faulted juxtaposition of the Jurassic Talkeetna of the Peninsular sequence in eastern-southern Alaska against the Wrangellia sequence in the Wrangell Mountains requires extensive post-Middle Jurassic tectonic displacement of this part of the Peninsular sequence relative to the Wrangellia sequence. This post-Jurassic displacement resulted in juxtaposition of different facies, hence in the original designation of the former Peninsular and Wrangellia terranes as separate units.

WRA **Alexander sequence (island arc) (southeastern Alaska and western Canadian Cordillera)**—Consists chiefly of Upper Proterozoic to middle Paleozoic volcaniclastic turbidite deposits, siliceous shale, chert, limestone, intermediate to mafic volcanic rocks, local polymictic conglomerate, and early to middle Paleozoic plutonic rocks. These rocks are interpreted by be overlain by late Paleozoic and early Mesozoic units of the Wrangellia sequence, and by younger overlap assemblages. Age of exposed units decreases towards the north.

In the southern part of southeastern Alaska, the Upper Proterozoic and Lower Cambrian Wales Group consists of metamorphosed volcanic, turbidite, and carbonate rocks that are overlain by Ordovician through Mississippian interlayered volcaniclastic turbidite deposits, carbonate rocks, and volcanic rocks, shallow-marine clastic and carbonate rocks. These lithologies comprise the Port Refugio and Karheen Formations, Heceta Limestone, and Descon Formations. In the northern part of southeastern Alaska, the equivalent units are the Ordovician through Devonian Gambier Bay, Freshwater Bay, and Cedar Cove Formations, the Kennel Creek Limestone, and the Bay of Pillars, Point Augusta, Hood Bay, Cannery, Saginaw Bay, and Iyoukeen Formations.

The Alexander sequence includes abundant early to middle Paleozoic granitic to gabbroic and minor ultramafic plutons. In southeastern Alaska, the Alexander sequence and overlying Wrangellia sequence are locally unconformably overlain by parts of Gravina-Nutzotin-Gambier belt (unit gg) which includes the Douglas Island Volcanics and Brothers Volcanics, and the Seymour Canal and Gravina Island Formations. The Gravina-Nutzotin-Gambier belt (unit gg) and adjacent unit are intruded by coeval plutonic rocks of the Muir-Chichagof belt and Gravina arc. Locally unconformably overlain by Tertiary and Quaternary basalt, dacite, rhyolite, sandstone, and minor conglomerate. In southeastern Alaska, the Alexander and overlying Wrangellia sequences are faulted against the Chugach terrane to west and against the Taku terrane to east. The Alexander terrane is interpreted as a displaced fragment of an early through middle Paleozoic island arc.

For paleomagnetic determinations, six localities in the Alexander sequence range in age from Lower Devonian (grade B) through Mississippian, Pennsylvanian, Triassic and Late Cretaceous (all grade A). The localities consist almost exclusively of sedimentary rocks, except for the 23 Ma old Point Camden pluton (grade C). All localities of Triassic and older age indicate near equatorial ($<17^{o}$) paleolatitudes and southward displacements with respect to North America ranging from 17^{o} to zero. The Point Camden pluton shows no displacement.

In the Canadian Cordillera, the Alexander sequence extends southwards south of latitude 54° N, into the western Coast Belt, where it consists of metasedimentary and metavolcanic screens and septa within Cretaceous and early Tertiary granitic rocks. Recent U-Pb zircon dating of conglomerate clasts indicates that the Alexander terrane (Karheen conglomerate) extends nearly as far south as latitude 52° N (G.E. Gehrels, personnel commun. 1992). **REFERENCES**: Loney and others, 1975; Symons, 1977; Turner and others, 1977; Van der Voo and others, 1980; Eberlein and others, 1983; Brew and others, 1984; Panuska, 1984; Gehrels and Saleeby, 1986, 1987; Gehrels and others, 1987; Monger and Berg, 1987; Berg and others, 1988; Brew and others, 1991; Gehrels, 1990, 1991; D.A. Brew, written commun., 1991; McClelland and others, 1991; Haeussler and others, 1992a, 1992b; McClelland and Gehrels, 1992; Bazard and others. 1993

WRA **Alexander sequence (island arc) (Eastern-southern Alaska)**—Exposed in the eastern Wrangell Mountains, eastern Alaska Range, and northern part of Chugach Mountains. In Wrangell Mountains, consists chiefly of early to middle Paleozoic Kaskawulsh metamorphic rocks of Gardner and others (1988) which are equivalent to the Kaskawulsh Group in adjacent parts of Canada (MacKevett, 1978; Campbell and Dodds, 1982a, b; Gardner and others, 1988). The Kaskawulsh metamorphic rocks consist mainly of a highly deformed assemblage of early Paleozoic marble, greenstone, metagreywacke, phyllite, slate, schist, argillite, siltstone, mafic volcanic rocks, and volcaniclastic rocks that together are a few thousand meters thick, and are multiply folded and locally strongly schistose. The Kaskawulsh metamorphic rocks are metamorphosed from upper greenschist to amphibolite facies. Devonian and older megafossils are widely distributed in the unit in Alaska and in the Yukon Territory to the east. The Kaskawulsh metamorphic rocks are intruded by Middle Pennsylvanian Bernard Creek pluton which is composed of granite, syenite, and alkalic granite, and by Jurassic and Cretaceous tonalite and granodiorite of Chitina and Chisana arcs. Intrusion of the Middle Pennsylvanian Bernard Creek pluton into both the Alexander and Wrangellia sequences indicates either stratigraphic continuity or structural juxtaposition by about the Early Pennsylvanian.

In the eastern Alaska Range in eastern-southern Alaska, the Alexander sequence is interpreted to consist of: (1) pre-Pennsylvanian units of mica and quartz schist; and (2) younger metagranitic rocks. These two units occur in roof pendants in Pennsylvanian granitic rocks which also intrude late Paleozoic volcanic and related rocks of the Wrangellia sequence (Nokleberg and others, 1994b). In the northern Chugach Mountains, north of the Border Ranges fault, the Alexander sequence is interpreted to consist of sparse roof pendants of quartz and pelitic schist and marble (Knik River terrane) that either are present in, or are faulted against, the adjacent Border Ranges ultramafic-mafic assemblage of the Peninsular sequence (Plafker and others, 1989b; Nokleberg and others, 1994b). The Alexander sequence in southern Alaska is interpreted as a displaced fragment of an early and middle

Paleozoic island arc. **REFERENCES**: MacKevett, 1978; Campbell and Dodds, 1982a, b; Gardner and others, 1988; Plafker and others, 1989b; Nokleberg and others, 1994a, b

WRP **Peninsular sequence (island arc) (Southern Alaska)**—Exposed mainly on the Alaska Peninsula, Kodiak Island and adjacent area to northeast, and the Kachemak Bay area of the Kenai Peninsula. Consists mainly of an areal extensive Jurassic island arc volcanic and plutonic sequence (Talkeetna arc) and associated sedimentary strata. Volcanic and plutonic sequence consists mainly of: (1) Upper Triassic (Norian) and Lower Jurassic andesitic flows, breccia, and volcaniclastic siltstone and sandstone (Talkeetna Formation, volcanic part of Talkeetna arc); (2) Jurassic batholithic granitic rocks (plutonic part of Talkeetna arc); and (3) Middle Jurassic to Cretaceous arc-derived clastic rocks (Shelikof and Chinitna Formations, Tuxedni Group, and Kialagvik, Naknek, Staniukovich, and Herendeen Formations), and bioclastic limestone with Boreal fauna (Nelchina Limestone). Unconformably overlying units are Cretaceous to lower Tertiary progradational marine and nonmarine sandstone, shale, and minor conglomerate (Matanuska, Hoodoo, Chignik, and Kaguyak Formations).

The southern part of the Peninsular sequence, adjacent to the Denali fault, consists of the Early Jurassic Border Ranges ultramafic-mafic assemblage (BRUMA) which is interpreted as the roots of the Talkeetna arc (Plafker and others, 1989b; Nokleberg and others, 1994b). The Peninsular sequence was probably originally overlain by the Kahiltna sedimentary and volcanic assemblage (unit kh) along southern part of northwestern margin, but is thrust over the Kahiltna overlap assemblage along the Talkeetna thrust. The Peninsular sequence is bounded to southeast by the Border Ranges fault and Chugach terrane, and is locally extensively overlain by Cenozoic volcanic rocks of Aleutian arc (unit al).

For paleomagnetic determinations, five sedimentary rock localities range from Jurassic through to Paleocene (55 Ma) in age. The best defined localities yield grade A results that are obtained from Jurassic and Paleocene sedimentary rocks, and indicate southerly displacements with respect to North America of between 18^{o} and 32^{o}. The other localities indicate generally larger displacements; the discrepancy is commonly ascribed to inclination errors acquired during sedimentation. The Peninsular sequence interpreted mainly as a Late Triassic and Jurassic oceanic island arc. **REFERENCES**: Stone and Packer, 1979; Jones and others, 1981; Stone and others, 1982; Pavlis, 1983; Burns, 1985; Panuska and Stone, 1985; Stamatakos and others, 1986; Plafker and others, 1989b; Stamatakos and others 1989; Detterman and others, in press; Wilson and others, in press

WRW **Wrangellia sequence (island arc) (Southern and southeastern Alaska, and Alaska Peninsula)**—Consists chiefly of late Paleozoic and Mesozoic sedimentary, volcanic, and plutonic rocks. In southern Alaska, the Wrangellia sequence consists of: (1) Pennsylvanian and Permian island-arc-related volcanic breccias, flows, and volcaniclastic rocks, mainly andesite and dacite, and associated marine sedimentary rocks (Tetelna Volcanics, and Station Creek and Slana Spur Formations); (2) Permian limestone, pelitic rocks, and chert (Hasen Creek and Eagle Creek Formations); (3) Triassic (Ladinian) black cherty argillite; (4) a thick section of Upper Triassic (Norian) subaerial and marine tholeiitic pillow basalt and lesser argillite (Nikolai Greenstone, up to thousand meters thick); (5) Upper Triassic (Norian) platform and basinal limestone (Chitistone and Nizina Limestones); and (6) Upper Triassic and Jurassic basinal, siliceous, argillaceous and calcareous rocks (McCarthy Formation). On northern flank of the Wrangell Mountains, the Wrangellia sequence is unconformably overlain by Upper Jurassic and Lower Cretaceous flysch and andesite (Gravina-Nutzotin-Gambier belt and Chisana Formation) form part of a major tectonically-collapsed flysch basin that is intruded by coeval granitic plutons. On southern flank of the Wrangell Mountains, the Wrangellia sequence is unconformably overlain by mainly Middle Jurassic to Maastrichtian progradational volcaniclastic sequences (Root Glacier, Nizina Mountain, Chititu, Moonshine Creek, Schulze, and Kennicott Formations) Throughout Wrangel Mountains, the Wrangellia sequence is also overlain by late Cenozoic to Holocene volcanic rocks of the Wrangell volcanic field (unit wr).

The late Paleozoic sedimentary and volcanic rocks in the Wrangellia sequence in eastern-southern Alaska are intruded by coeval metaplutonic rocks of the Skolai island arc. The Upper Triassic basalt and older rocks are intruded by mafic and ultramafic dikes, sills, and small plutons. The Upper Triassic basalt and associated plutonic rocks are interpreted as products of rifting or oceanic plume volcanism. The Wrangellia sequence is locally intruded by extensive Late Jurassic and Early Cretaceous granitic plutons (Chisana, Chitina, and Glacier Bay-Chichagof arcs). Pervasive weak greenschist facies metamorphism is present in Early Cretaceous and older rocks. In the eastern Wrangell Mountains, the Wrangellia sequence linked to northern Alexander sequence by Middle Pennsylvanian granitic plutons (Skolai arc). In southern Alaska, the Wrangellia sequence is faulted against the Yukon-Tanana and Maclaren terranes to north along the Denali fault and Broxson Gulch thrust, respectively, and to the south is faulted against the Gulkana River terrane along the Chitina Valley and Paxson Lake faults.

For paleomagnetic determinations in eastern-southern Alaska and on Vancouver Island in the southern Canadian Cordillera, the Wrangellia sequence is well studied with 17 localities. The overall age range for samples from the Wrangellia sequence is Pennsylvanian to Eocene. Most of the high quality data are from the Upper Triassic Nikolai Greenstone and indicate equatorial paleolatitudes and significant southerly displacement with respect to North America (ranging from 21^{o} to 42^{o}). Similar data are obtained for the correlative Karmutsen Group on Vancouver Island. The sparse data for intermediate age localities do not permit determination of the arrival of the terrane in its present position. Grade B data for the latest Cretaceous sedimentary rocks of the MacColl Ridge Formation indicate an apparently unreasonably low paleolatitude and large displacement. Possibly a synfolding remagnetization or a depositional inclination error is present in these rocks. The data from Paleocene and younger localities indicate near zero displacement with respect to North America.

On the Alaska Peninsula, the Wrangellia sequence consists of late Paleozoic and early Mesozoic island arc and oceanic sequences that are exposed in the Puale Bay area and areas to the north. Major units are: (1) Pennsylvanian(?) andesite flows and agglomerate; (2) Permian limestone; and (3) Upper Triassic (Norian) basalt, mafic tuff, limestone, and argillite (Kamishak Formation), and correlative units (Cottonwood Bay and Chilikadrotna Greenstones and informally-named Tlikalika complex, Wallace, 1983).

In southeastern Alaska, the Wrangellia sequence consists of: (1) late Paleozoic clastic and carbonate rocks; and (2) Upper Triassic mafic and lesser silicic volcanic rocks. Major units are Mississippian, Pennsylvanian, and Lower Permian clastic, volcaniclastic, and carbonate rocks (Cannery, Pybus, Ladrones Limestone, and Saginaw Bay, and Klawak Formations), and Upper Triassic mafic and lesser silicic volcanic and carbonate rocks (Hyd Group, Keku Volcanics, Goondip Greenstone, Retreat Group (Duttweiler-Kelly, 1990), White Stripe Marble, Chapin Peak Formation, and an unnamed sequence on the Chilkat Peninsula). Overlying the Wrangellia sequence is the Late Jurassic and Lower Cretaceous Gravina-Nutzotin-Gambier belt (unit gg).

In eastern-southern Alaska, the southern margin of the Wrangellia superterrane includes the Gulkana River terrane (former southern Wrangellia terrane of Plafker and others, 1989b, and Nokleberg and others, 1994a, b) that consists mainly of two sequences. (1) An older fault-bounded sequence that is generally composed of highly deformed and metamorphosed sedimentary and volcanic rocks of late Paleozoic and older age (stratified part of metamorphic complex of Gulkana River and Strelna Metamorphics of Plafker and others, 1989b). The metamorphosed sedimentary and volcanic rocks are mainly chlorite schist derived from andesite, metabasalt, metatuff, calc-schist, pelitic schist, metachert, and marble. The marble locally contains Lower Pennsylvanian conodonts. And (2) a younger sequence that is composed of metamorphosed and deformed late Paleozoic and Late Jurassic metaplutonic rocks (plutonic part of metamorphic complex of Gulkana River and Uranatina River metaplutonic unit of Plafker and others, 1989b). The Paleozoic metaplutonic rocks yield U-Pb ages of 308 to 312 Ma and consist of schistose hornblende diorite and gabbro, metagranodiorite, metagranite, and orthogneiss. Late Jurassic metaplutonic rocks, with an U-Pb zircon age of 153 Ma, consist mainly of hornblende diorite and tonalite.

The Gulkana River terrane is generally intensely deformed and regionally metamorphosed from greenschist facies to amphibolite facies near metaplutonic rocks. Local mylonite zones occur adjacent to and within syntectonic Late Jurassic metaplutonic rocks. The Gulkana River terrane is locally structurally overlain by the Upper Triassic Nikolai Greenstone and Chitistone and Nizina Limestones of the Wrangellia superterrane. The Late Paleozoic part of the terrane are interpreted as comprising part of the late Paleozoic Skolai arc of the Wrangellia superterrane. The Late Jurassic metaplutonic rocks constitute the Chitina arc of eastern-southern Alaska. The Gulkana River terrane locally forms moderate-size klippen thrust onto northern Chugach terrane during mid-Cretaceous faulting along the Border Ranges fault. The Gulkana River terrane is interpreted either as: (1) a deeper and more metamorphosed equivalent of the Wrangellia sequence to the north; or (2) as a distinct terrane structurally juxtaposed between the Wrangellia sequence to the north and the Peninsular sequence to south. The Gulkana River terrane is equivalent to the Strelna terrane of Grantz and others (1991).

REFERENCES: Symons, 1973a, 1983, 1985a; Richter and others, 1975; Richter, 1976; Jones and others, 1977; Hillhouse, 1977; MacKevett, 1978; Panuska and Stone, 1981; Silberling and others, 1981; Hillhouse and Gromme, 1984; Panuska, 1984, 1985; Johnson and Karl, 1985; Nokleberg and others, 1985, 1992, 1994a, b; Hicken and Irving, 1987; Irving and Yole, 1987; Gardner and others, 1988; Plafker and others, 1989a, b; Barker and others, 1989; Irving and Brandon, 1990; Irving and Wynne, 1990; Richards and others, 1993

WRW **Wrangellia sequence (island arc) (Western Canadian Cordillera)**—Exposed mainly on Vancouver and Queen Charlotte Islands and consists of: (1) Upper Devonian arc-related volcanic and sedimentary strata that yield a U-Pb zircon age of 367 Ma (Sicker Group) and coeval intrusions; (2) overlying Upper Carboniferous and Lower Permian clastic and carbonate rocks (Buttle Lake Group of Muller, 1980; Massey and Friday, 1989; Parrish and McNicoll, 1992); (3) locally overlying Ladinian black argillite; (4) the distinctive Middle(?) to Upper Triassic tholeiitic basalt and associated mafic intrusions (Karmutsen Formation); (5) overlying shallow-marine carbonate rock; and (6) Lower Jurassic deep-water clastic rocks (Quatsino, Parsons Bay, and Harbledown Formations). The Triassic and Jurassic units may represent a large oceanic basalt plateau and overlying successively deeper deposits (Jones and others, 1977). The Wrangellia sequence is overlapped by Lower Jurassic volcanic arc rocks (Bonanza Formation) and intruded by Early and Middle Jurassic granitic intrusions. The depicted stratigraphic column is for Vancouver Island. Permian brachiopod and bryozoa are high-latitude, cool-water, either Boreal or Uralian (Yole, 1969). Pliensbachian faunas indicate the Canadian Cordilleran part of the Wrangellia sequence formed at latitude of northern California (Smith and Tipper, 1986). **REFERENCES:** Yole, 1969; Jones and others, 1977; Muller, 1980; Smith and Tipper, 1986; Clowes and others, 1987; Gardner and others, 1988; Massey and Friday, 1989; Plafker and others, 1989b; Nokleberg and others, 1989b; Parrish and McNicoll, 1992; Monger, 1991c; Journeay 1990; Grantz and others, 1991; Parrish and McNicoll, 1992; van der Heyden, 1992

WS **Wickersham terrane (passive continental margin) (East-central Alaska)**—Consists chiefly of turbidite deposits comprising two major lithofacies: (1) a structurally lower unit of mainly gray, maroon, and green slate with local quartzose sandstone and granule to pebble conglomerate, and dolomite and dark limestone; and (2) an upper unit of mainly thick-bedded quartzose sandstone and pebble conglomerate with local layers of gray slate that contain local *Oldhamia* trace fossils of probable Cambrian age. The Wickersham terrane is equivalent to the Beaver terrane of Churkin and others (1982). The southern margin of the Wickersham terrane exhibits penetrative metamorphic fabric and lower greenschist metamorphism that parallels the fault bounding southern margin. The Wickersham terrane is singly deformed and weakly metamorphosed and structurally overlies the White Mountains terrane to the northwest and the Fairbanks schist unit of Nokleberg and others (1989a) of the Yukon-Tanana terrane to southeast. The Wickersham terrane is interpreted as a displaced fragment of the early Paleozoic continental margin of North America. **REFERENCES**: Churkin and others, 1982; Weber and others, 1985, 1988; Pessel and others, 1987; Moore and Nokleberg, 1988; Dover, 1990; Grantz and others, 1992

WSA **West Sakhalin terrane (turbidite basin) (Sakhalin Island, Russian Southeast)**—Consists chiefly of: (1) a basal sequence of Lower Cretaceous volcanic rock, jasper, and pelagic rocks (Samokhinskaya, Pobedinskaya, and Tymovskaya sequences); and (2) Upper Cretaceous clastic and tuffaceous clastic rocks that contain *Inoceramus* and ammonites (Arkovskaya and Krasnoyarkovskaya sequences). The Upper Cretaceous rocks are interpreted forearc trough deposits and are overlapped by Tertiary conglomerate and sandstone. The West Sakhalin terrane contains northwest-striking major folds and is interpreted as a forearc basin that formed along the igneous arc represented by the East Sikhote-Alin volcanic-plutonic belt (unit es) in eastern part of the Russian Southeast. West Sakhalin terrane correlated with Sorachi-Yezo terrane on Hokkaido Island in northern Japan. Both the West Sakhalin and Sorachi-Yezo turbidite basin terranes are interpreted as forearc basin units for the East-Sikhote-Alin volcanic-plutonic belt. For paleomagnetic determinations, three localities of Upper Cretaceous age yield grade C results and indicate southerly displacements of $5^{o}\pm10^{o}$, $12^{o}\pm7^{o}$ and $20^{o}\pm3^{o}$ with respect to the Siberian platform. Taking error into account, the best estimate suggests displacement to the south of about 15^{o}. **REFERENCES**: Geology of the U.S.S.R., Sakhalin Island, 1970; Pechersky, 1970; Parfenov, 1984; Zyabrev, 1984; Nevolina and Sokarev, 1986

WY **Windy terrane (metamorphic) (Central and eastern Alaska Range, Alaska)**—Forms narrow, discontinuous lenses along the Denali fault and consists of a structural melange of: (1) small to large fault-bounded lenses of Silurian or Devonian limestone and marl; (2) Upper Triassic limestone; (3) Jurassic(?) basalt and chert; (4) Cretaceous flysch and volcanic rocks, mainly argillite, quartz-pebble siltstone, quartz sandstone, metagraywacke, metaconglomerate, and lesser andesite and dacite; and (5) Cretaceous(?) gabbro and diabase dikes and sills. Flysch contains sparse Cretaceous ammonites. The terrane is intensely faulted and sheared and displays a weak to intense schistosity formed at lower greenschist facies. Local phyllonite and protomylonite also occur. The Windy terrane has a minimum structural thickness of a few thousand meters. The Windy terrane is interpreted as a structural melange that formed by tectonic mixing during Cenozoic dextral-slip movement along the Denali fault. Mesozoic flysch and associated volcanic rocks interpreted as tectonic remnants of the Kahiltna sedimentary and volcanic assemblage (unit kh) and Late Jurassic and Early Cretaceous plutonic rocks (Chisana arc). Fragments of Silurian(?) and Devonian limestone and marl may be derived from the Dillinger, Mystic, or Nixon Fork terranes.

The Windy terrane contains a unit of (Mesozoic?) ultramafic and associated rocks that are too small to depict on the map. The ultramafic and associated rocks are exposed in narrow, fault-bounded, near-vertical prisms and sparse klippen that occur discontinuously for several hundred kilometers along the Denali fault in the eastern and central Alaska Range. The ultramafic rocks are mainly fine- to medium-grained pyroxenite and peridotite, and fine-grained dunite and are largely altered and highly sheared to serpentinite. Associated rocks are amphibolite, hornblende-plagioclase gneiss, marble derived from calcareous sedimentary rocks, and weakly metamorphosed hornblende gabbro, tonalite, and granite. Amphibolite and gneiss enclose ultramafic rocks. Intense strong schistosity subparallels contacts and enclosing faults. Tonalite and granite intrude ultramafic and associated rocks form small elongate plutons with moderate schistosity that subparallels contacts. The terrane of ultramafic and associated rocks is interpreted as part of a crustal-suture belt composed of fragments of either oceanic lithosphere, an island arc, or less likely deep-level continental lithosphere. The terrane of ultramafic and associated rocks may be composed in part of basement rocks juxtaposed along the Denali fault. **REFERENCES**: Richter, 1976; Jones and others, 1981; Nokleberg and others, 1985, 1989a, 1992, 1994a, b; Csejtey and others, 1986; Patton and others, 1992; Stanley and others, 1990

YA **Yakutat terrane (accretionary wedge - predominantly turbidites) (Southern Alaska and northern Gulf of Alaska)**—An composite terrane that consists of the Mesozoic Yakutat Group in the eastern part and Eocene oceanic crust in the western part. Both the eastern and western parts are overlain by younger Cenozoic sedimentary and volcanic rocks. The Yakutat Group is divided into: (1) melange facies, chiefly basalt, chert, argillite, tuff, and sandstone of Upper Jurassic(?) and Early Cretaceous age, and exotic blocks of Permian and Upper Triassic carbonate rocks, and Middle and Late Jurassic tonalite; and (2) flysch facies, chiefly Upper Cretaceous volcanic sandstone, siltstone, and minor conglomerate with structurally interleaved lenses of disrupted chert, argillite, and volcanic rocks. The Yakutat Group is metamorphosed from zeolite to lower greenschist facies and is intruded by Eocene granitic plutons. Cenozoic sedimentary and volcanic rocks are divided into: (1) early and middle Tertiary oceanic basalt, sandstone, siltstone, shale, and conglomerate (Poul Creek, Redwood, Kulthieth, and Tokun Formations) that includes Eocene basalt and shale rich in organic material; and (2) an overlap sequence of Miocene and younger shallow marine sandstone, siltstone, diamictite, and conglomerate (Yakataga and Redwood Formations). The Yakutat terrane is thrust under Prince William terrane to north along gently north-dipping Chugach-Saint Elias fault, and to west along subhorizontal Kayak Island fault zone; underthrust by Pacific plate to south along Transition fault. The Yakutat terrane is interpreted as a fragment of Chugach terrane (Yakutat Group) and Eocene oceanic crust that, together with overlying pre-Miocene sequence, was displaced at least 600 km northward along the Fairweather transform fault since the early Miocene. **REFERENCES**: Jones and others, 1981; Plafker, 1987

YN **Yanranay terrane (accretionary wedge - predominantly turbidites) (Eastern part of Russian Northeast)**—Consists chiefly of two sequences. (1) Upper Jurassic and Cretaceous (as young as Campanian) oceanic basalt, pelagic sedimentary rocks, chert, and rare carbonate rocks with a condensed section of radiolarite and jasper with radiolarians of Tithonian, Berriasian and Valanginian ages. Basalt composed of pillow and massive oceanic tholeiitic and alkalic olivine basalt, and display REE patterns that resemble MORB-type basalt. REE patterns of interlayered chert are typical of oceanic sedimentary rocks. And (2) Lower and Upper Cretaceous argillite, siltstone, sandstone, and associated rocks. Siltstone, volcaniclastic graywacke, and sandstone predominate in the late

Neocomian and Aptian rocks. Lower part of Upper Cretaceous sequence consists of interbedded oceanic basalt, hyaloclasite, and chert with Albian-Senomanian and Santonian-Campanian radiolarians and local iron-manganese layers. Units locally present are: (1) chert, carbonate rocks, calcarenite, and bioclastic limestone layers that contain Campanian *Inoceramus* and gastropods; and (2) a late Senonian olistostrome composed of fragments of Paleozoic to early Mesozoic and Upper Jurassic to Lower Cretaceous sedimentary and volcanic rocks in a siltstone matrix. The terrane contains local folds, thrusts, imbricated fault slices, and duplex structures. Thickness of units in terrane ranges between 100 and 1,500 m. The terrane is exposed in tectonic windows beneath Ekonay terrane and is unconformably overlain by late Maastrichtian clastic rocks. The Yanranay terrane is interpreted as an accretionary wedge assemblage that was tectonically paired to the Okhotsk-Chukotka volcanic-plutonic belt. **REFERENCES**: Byalobzhesky and others, 1986; Grigoriev and others, 1987b; Sokolov, 1992.

YO **York terrane (passive continental margin) (Western Seward Peninsula, northwestern Alaska)**—Consists chiefly of a weakly metamorphosed, structurally complex assemblage of Ordovician through Mississippian limestone, argillaceous limestone, dolostone, and fine-grained clastic rocks that were deposited in shallow-marine environments. Ordovician carbonate rocks comprise most of unit and may range up to 3,000 m thick. Upper Proterozoic rocks also may be present. The York terrane is intruded by small Late Cretaceous granitic stocks and may correlate with passive continental margin rocks of Hammond terrane to northwest. The York terrane is interpreted as a displaced fragment of the Paleozoic and early Mesozoic continental margin of North America. **REFERENCES**: Sainsbury, 1969; Hudson, 1977; Till and Dumoulin, 1994

YT **Yukon-Tanana terrane (metamorphosed continental margin) (East-central Alaska, southeastern Alaska, and western Canadian Cordillera)**—Composed of a large tract of generally polymetamorphosed and multiply-deformed continental margin sedimentary rocks and lesser continental margin arc rocks. Occurs in a vast tract the North American Cordillera in east-central Alaska, southeastern Alaska, and the Canadian Cordillera. Because of regional (geographic) differences and because of studies by different groups, terrane is described separately by region. Locally divided into subterranes (Nokleberg and others, 1989a, 1992; Mortensen, 1992a).

East-central Alaska—Consists chiefly of an enormous tract of polydeformed and polymetamorphosed middle Paleozoic and older sedimentary, volcanic, and plutonic rocks. Three major sequences of metasedimentary, metavolcanic, and metaplutonic rocks constitute various subhorizontal to gently folded thrust slices. Major sequences are: (1) Mississippian, Devonian, and locally older metasedimentary rocks, mainly pelitic schist, quartz schist, quartz-feldspar schist, and sparse marble (Fairbanks, Birch Hill, and Chena River subterranes, and metasedimentary parts of the Jarvis Creek Glacier, Hayes Glacier, Lake George, and Macomb subterranes; the Totatlanika Schist, and the Keevey Peak Formation); (2) Devonian and Mississippian orthogneiss and augen gneiss (metaplutonic part of Lake George and Macomb subterranes); and (3) Devonian and Mississippian intermediate and silicic metavolcanic rocks (Butte subterrane, metavolcanic rock parts of Jarvis Creek, Hayes Glacier, and Lake George subterranes; the Cleary sequence within Fairbanks schist unit, and the Spruce Creek sequence in the Kantishna Hills area). The extrusive metavolcanic rocks and coeval metamorphosed hypabyssal igneous rocks which are mainly metamorphosed andesite, dacite, and keratophyre flows and tuffs, are interlayered with the Mississippian, Devonian, and locally older metasedimentary rocks.

U-Pb igneous isotopic analyses indicate Devonian and Mississippian extrusion of intermediate and silicic metavolcanic rocks (Cleary sequence of Fairbanks subterrane, and Spruce Creek sequence) (Aleinikoff and Nokleberg, 1989; Nokleberg and others, 1989a; J.N. Aleinikoff, T.K. Bundtzen, and W.J. Nokleberg, unpub. data, 1993). Conodont and megafossil ages indicate Mississippian and Devonian ages for metasedimentary rock part of Jarvis Creek Glacier subterrane and Totatlanika Schist. One Late Proterozoic metagranitic pluton intrudes metasedimentary rocks in the northern part of Chena River subterrane (Nokleberg and others, 1989a), indicating at least part of metasedimentary rocks are pre-Late Proterozoic in age. Abundant Cretaceous(?) metadiabase and metagabbro dikes, sills, and small plutons occur locally near Denali fault.

The Yukon-Tanana terrane contains an intense subhorizontal to gently dipping structural fabric that is defined by parallel schistosity and compositional layering that are subparallel to major subhorizontal faults that separate major thrust slices. Faults between the major thrust slices exhibit both older early Mesozoic thrust and younger mid-Cretaceous extensional displacements. The higher-grade units, with abundant Devonian and Mississippian orthogneiss and augen gneiss, and display upper amphibolite to eclogite facies metamorphism and generally are present in deeper structural levels. The lower-grade units, with abundant Devonian and Mississippian volcanic rocks, display upper greenschist facies metamorphism and generally are present in higher structural levels. An intense zone of retrogressive metamorphism and mylonitic schists occurs along the southern margin of the terrane. The major periods of amphibolite to eclogite facies metamorphism are interpreted as having occurred in the Early Jurassic and mid-Cretaceous.

The southern margin of the Yukon-Tanana terrane is faulted against mainly the Windy terrane and the Wrangellia superterrane. The northwestern margin is thrust under the Wickersham terrane. The northeastern margin of the Yukon-Tanana terrane is faulted against the North America craton margin, the Kandik River overlap assemblage, and the Angayucham, and Crazy Mountains terranes along the Tintina fault. The southern part of the Yukon-Tanana terrane is interpreted as being structurally underlain in part by Mesozoic flysch of the Kahiltna overlap assemblage (Stanley and others, 1990). The Yukon-Tanana terrane is locally structurally overlain by formerly extensive klippen of the Seventymile and Stikinia(?) terranes in east-central Alaska. In the same area, the Yukon-Tanana terrane is locally unconformably overlain by Upper Cretaceous and lower Tertiary conglomerate, sandstone, coal, and rhyolite to basalt tuff and flows, and is intruded by extensive mid-Cretaceous, Late Cretaceous, and early Tertiary granitic plutons. The Yukon-Tanana terrane is interpreted as a highly metamorphosed, deformed, and displaced fragment of the North American continental margin. The Yukon-Tanana terrane is the former Yukon Crystalline terrane of Churkin and others, 1982. **REFERENCES**: Foster, 1976; Foster and others, 1987, 1994; Nokleberg and others, 1989a, 1992; Stanley and others, 1990; Dusel-Bacon, 1991; Pavlis and others, 1993; Dusel-Bacon and Hansen, 1992

Southeastern Alaska—Consists chiefly of Late Proterozoic(?) or early and middle Paleozoic mica schist, granitic orthogneiss, amphibolite, metavolcanic rocks, quartzite, marble, and calc-silicate rocks. Protoliths are quartz-rich and pelitic sedimentary rocks, carbonate rocks, intermediate to mafic volcanic rocks, ultramafic rocks, and sparse metamorphosed middle Paleozoic granitic plutons. The terrane includes early Paleozoic metasedimentary rocks of Nisling assemblage (marble, metamorphosed quartz sandstone, pelitic schist, and metabasalt), middle Paleozoic metasedimentary and metavolcanic rocks of Ruth assemblage and Kah Shakes sequence (pelitic schist, marble, mafic and felsic metavolcanic rocks, metagranodiorite and orthogneiss) (former Tracy Arm terrane), and the informally named Paleozoic East Behm gneiss complex of metaplutonic rocks of Saleeby and Rubin (1990). Metamorphosed prior to the Late Triassic to amphibolite-facies.

The Yukon Tanana terrane is intruded by Late Cretaceous and early and middle Tertiary intermediate plutonic rocks. The Yukon-Tanana terrane is bounded to the west by the Taku terrane, Wrangellia superterrane, and the Gravina-Nutzotin-Gambier belt (unit gg), and is either stratigraphically(?) or structurally(?) overlain by the Stikinia terrane. The Yukon-Tanana terrane is interpreted as a highly metamorphosed and deformed displaced fragment of the North American continental margin. **REFERENCES**: Gehrels and others, 1990; Saleeby and Rubin, 1990; Rubin and Saleeby, 1991; McClelland and others, 1991, 1992; Samson and others, 1991; Gehrels and McClelland, 1992

Western Canadian Cordillera—Consists chiefly of variably metamorphosed and sheared rocks, possibly ranging from Proterozoic to early Mesozoic age but predominantly middle and late Paleozoic age (Mortensen, 1992a). Includes pelitic to quartzofeldspathic schist and gneiss, marble, mafic to felsic metavolcanic and metaplutonic rocks, and minor blueschist and eclogite (Tempelman-Kluit, 1979; Mortensen, 1992a). Metaplutonic rocks are dominated by Late Devonian to Early Mississippian peraluminous granite augen gneiss (Pelly Gneiss suite of Wheeler and others, 1991 and Mortensen, 1992a), and coeval massive to strongly deformed metaluminous hornblende-bearing granodiorite (Simpson Range Suite of Wheeler and others, 1991) and Mortensen, 1992a). The Devonian and Mississippian metaplutonic rocks have moderate to high initial-strontium ratios and marked inheritance of Proterozoic zircons (Mortensen, in press). Middle Permian radiometric ages exist for minor foliated metaplutonic rocks and for interlayered blueschist (Erdmer and Armstrong, 1988).

The metamorphosed clastic part of the Yukon-Tanana terrane is interpreted as being derived from a continental margin. The extensive middle Paleozoic granitoids are interpreted as part of a continental-margin arc in the Devonian and Mississippian, and the minor Permian granitic rocks and blueschist suggest an arc-subduction zone setting (Mortensen, 1992a). Two partly contrasting views exist on the significance of blueschist and eclogite in the terrane: (1) the blueschist and eclogite constitute a highly disrupted arc-trench melange (Tempelman-Kluit, 1979; Hansen, 1991); or (2) the blueschist and eclogite constitute a subduction zone assemblage formed along the margin of the terrane (Mortensen, 1992a).

In the Canadian Cordillera, the Yukon-Tanana terrane includes the Nisutlin subterrane of the Kootenay terrane and the Nisling terrane of Wheeler and others (1991). The distinction between the Yukon-Tanana and Kootenay terranes in the southern Canadian Cordillera is based on geographic location. The Kootenay terrane is located to the southeast of the Yukon-Tanana terrane. The relations between the Yukon-Tanana terrane and the Nisling terrane of Wheeler and others (1991) are unclear, and for simplicity in this study, the two units are combined. Nelson and Mihalnuk (1993) suggested that Nisling is part of Yukon-Tanana, but was rotated counter-clockwise along with the Stikinia terrane into its present position. The Yukon-Tanana is cut by post-Late Triassic thrusts along with the Slide Mountain terrane (Mortensen, 1992a) and in Alaska by Early Cretaceous low-angle extensional faulting (Hansen, 1991). Most metamorphic mineral cooling ages from the Yukon-Tanana terrane range from Early Jurassic to mid-Cretaceous and may reflect prolonged cooling or overprinting by younger structural or magmatic events (Mortensen, 1992a). **REFERENCES**: Tempelman-Kluit, 1979; Erdmer and Armstrong, 1988; Gehrels and others, 1990; Jackson and others, 1990; Hansen, 1991; Wheeler and others, 1991; Mortensen, 1992a; McClelland, 1992; Currie and Parrish, 1993; Nelson and Mihalnuk, 1993; Mortensen, in press

ZL **Zolotogorskiy terrane (metamorphosed continental margin) (Northeastern part of Russian Northeast)**—Divided into three units. (1) A basal unit consists of zonally metamorphosed, Devonian(?) quartz-chlorite-mica-plagioclase schist with lesser actinolite, andalusite, cordierite, sillimanite, staurolite, and garnet, sparse marble, and metavolcanic rocks. (2) A middle unit that consists of Carboniferous and Permian quartz-feldspar and graywacke sandstone, siltstone, calcareous siltstone, calcareous sandstone, and limestone that contain corals, brachyopods, bryozoa, and crinoids. (3) An unconformably overlying upper unit that consists of Upper Jurassic to Lower Cretaceous (Valanginian) conglomerate which contains quartzite, limestone, and metavolcanic pebbles, minor basalt, mafic tuff, carbonaceous shale, siltstone, sandstone, limestone, and organogenic-clastic limestone that contains *Buchia*. The Zolotogorskiy terrane is intruded by Early Cretaceous granite and overlain by the Okhotsk-Chukotka volcanic-plutonic belt (unit oc). **REFERENCES**: Aleksandrov and others, 1977; Filatova, 1988; Ivanov and others, 1989

ZT **Zhuravlesk-Tumnin terrane (turbidite basin) (Eastern part of Russian Southeast)**—Consists chiefly of: (1) Upper Jurassic chert and basalt that formed in an upper oceanic crustal environment; and (2) a thick, continuous sequence of Lower Cretaceous turbidites (up to 13,000 m thick which were derived from both oceanic and continental regions. The source area for the turbidites include granitic and metamorphic rocks that are located both west and east of the turbidite basin. Appressed folds and thrust faults occur in the southern and central parts of terrane whereas large open folds occur in the northern part. The Zhuravlevka-Tumin terrane is intruded by Early Cretaceous high-alumina granitic rocks that yield K-Ar ages of 100 to 120 Ma and by granite rocks of the Upper Cretaceous and Paleogene East-Sikhote-Alin volcanic-plutonic belt (unit es). The Zhuravlevka-Tumin terrane is interpreted as forming during oblique collision of the Anui microcontinent and Samarka accretionary prism. **REFERENCES**: Krasny, 1966; Bersenev and others, 1969; Martynyuk and others, 1983; Nazarenko and Bazhanov, 1986; Markevich, 1971; Golozubov and others, 1992

REFERENCES CITED

Afitsky, A.I., 1970, Biostratigraphy of Triassic and Jurassic deposits in the vicinity of the Bolshoy Anyui River: Nauka, Moscow, 150 p. (in Russian).

Afitsky, A.I,. and Lychagin, P.P., 1987, Norian andesitic volcanism of Oloy zone: Tikhookeanskaya Geologiya, no. 3., p. 77-82. (in Russian).

Aleinikoff, J.N., and Nokleberg, W.J., 1989, Age of deposition and provenance of the Cleary sequence of the Fairbanks schist unit, Yukon-Tanana terrane, east-central Alaska, *in* Dover, J.H., and Galloway, J.P., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1988: U.S. Geological Survey Bulletin 1903, p. 75-83.

Aleinikoff, J.N., Dusel-Bacon, Cynthia, Foster, H.L., and Nokleberg, W.J., 1987, Pb-isotope fingerprinting of tectonostratigraphic terranes, east-central Alaska: Canadian Journal of Earth Sciences, v. 24, p. 2089-2098.

Aleinikoff, J.N., and Plafker, George, 1989, In search of the provenance and paleogeographic location of the White Mountains terrane: Evidence from U-Pb data of granite boulders in the Fossil Creek Volcanics, *in* Dover, J.H., and Galloway, J.P., eds., Geologic Studies in Alaska by the U.S. Geological Survey, 1988: U.S. Geological Survey Bulletin 1903, p. 68-74.

Aleksandrov, A.A., 1978, Nappe and imbricated structures of the Koryak Highland: Nauka, Moscow, 124 p. (in Russian).

Aleksandrov, A.A., Kichanov, V.I., and Kichanova, I.M., 1977, Metamorphic complexes of the Koryak Highland: Doklady Akademii Nauk SSSR, v. 237, p. 1426-1429 (in Russian).

Alekseev, E.S. 1982, Main features of development and structure of the southern Koryak Highland: Geotektonika, no. 1, p. 85-96 (in Russian).

Anderson, R.G.,1989, A stratigraphic, plutonic, and structural framework for the Iskut River map area, northwestern British Columbia, *in* Current Research, Part E, Geological Survey of Canada Paper 89-1E, p. 145-154.

Andrew, K.P.E., Hoy, T., and Drobe, J. 1990. Stratigraphy and tectonic setting of the Archibald and Elise Formations, Rossland Group, Beaver Creek area, southeastern British Columbia, *in* British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork 1989, Paper 1990-1, p. 19-27.

Androsov, D.V., 1992, Composition and genesis of Voznesenskoe fluorite-lead-zinc deposit (Primorye): Summary of Ph.D. dissertation, Russian Academy of Sciences, Vladivostok, 22 p. (in Russian).

Ansberg, Y.V., and Safronov, D.N., 1972, Distribution of boron in Triassic sedimentary rocks of the Anyui fold zone, western Chukotka: Doklady Akademii Nauk SSSR, v. 205, p. 696-699 (in Russian).

Archegov, V.B., Zinchenko, V.N., and Dranovsky, Ya. A., 1987, The Moma-Zyryanka basin: Sedimentary basins of the U.S.S.R. Far East and prospects of their oil- and gas-bearing capacity: Nedra, Leningrad, p. 93-102 (in Russian).

Archegov, V.B., Golovin, S.V., Zinchenko, V.N., Kirillov, V.O., and Chochia, N.G., 1987, Basins of the Priverkhoyansk marginal system: Sedimentary basins of the U.S.S.R. Far East and prospects of their oil-and gas-bearing capacity: Nedra, Leningrad, p. 60-91 (in Russian).

Archibald, D.A., Glover, J.K., Price, R.A., Farrar, E., and Carmichael, D.M., 1983, Geochronology and tectonic implications of magmatism and metamorphism, southern Kootenay arc and neighbouring regions, southeastern British Columbia. Part 1: Jurassic to mid-Cretaceous: Canadian Journal of Earth Sciences, v. 20, p. 1891-1913.

Arkhipov, Yu.V., 1984, Ophiolites, ultramafite-gabbro intrusions and associated formations of the Verkhoyansk-Kolyma foldbelt: Geology and Natural Resources of the Verkhoyansk-Kolyma Fold System, Yakutsk, p. 110-131 (in Russian).

Armstrong. R.L., 1988, Mesozoic and Cenozoic magmatic evolution of the Canadian Cordillera: Geological Society of America Special Paper 218, p. 55-91.

Armstrong, R.L., Harakal, J.E., Brown, E.H., Bernardi, M.L., and Rady, P.M., 1983, Late Paleozoic high-pressure metamorphic rocks in northwestern Washington and southwestern British Columbia: The Vedder Complex: Geological Society of America Bulletin, v. 94, p. 451-458.

Armstrong, R.L., Harakal, J.E., Forbes, R.B., Evans, B.W., and Thurston, S.P., 1986, Rb-Sr and K-Ar study of metamorphic rocks of the Seward Peninsula and southern Brooks Range, *in* Evans, B.W., and Brown, E.H., eds., Blueschists and Eclogites: Geological Society of America Memoir 164, p. 185-203.

Armstrong R.L., Parrish, R.R., Van der Heyden P., Scott, K., and Runkle D., 1991, Early Proterozoic basement exposures in the southern Canadian Cordillera: core gneiss of Frenchman Cap, Unit 1 of the Grand Forks gneiss, and the Vaseaux Formation: Canadian Journal of Earth Sciences, v. 28, p. 1169-1201.

Arthur, A.J., Smith, P.J., Monger, J.W.H., and Tipper, H.W., 1993, Mesozoic stratigraphy and Jurassic paleontology west of Harrison Lake, southwestern British Columbia: Geological Survey of Canada Bulletin 441, 62 p.

Atwater, Tanya, 1989, Plate tectonic history of the northeast Pacific and western North America, *in* Winterer, E.L., Jussong, D.M., and Decker, R.W., eds., The eastern Pacific Ocean and Hawaii: Geological Society of America, Geology of North America, v. N, p. 21-72.

Atwater, Tanya, and Severinghaus, Jeff, 1989, Tectonic map of the north-central Pacific Ocean, *in* Winterer, E.L., Hussong, D.M., and Decker, R.W., eds., The eastern Pacific Ocean and Hawaii: Geological Society of America, Geology of North America, v. N, plates 3A-C, scale 1:6,442,194.

Avchenko, O.V., 1977, Petrology of Okhotsk metamorphic complex: Nauka, Moscow, 95 p. (in Russian).

Avetisov, G. P., 1982, Seismological data on the deep structure of the New Siberian Islands and adjacent sea areas: Sovetskaya Geologiya, no. 11, p. 113-122.

Babcock, L.E., and Blodgett, R.B., 1992, Biogeographic and paleogeographic significance of Middle Cambrian trilobites of Siberian Aspect from southwestern Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 24, p. 4.

Babcock, L.E., Blodgett, R.B., and St. John, James, 1993, Proterozoic and Cambrian stratigraphy and paleontology of the Nixon Fork terrane: Proceedings of Circum-Pacific and Circum-Atlantic Terrane Conference, Guanajuato, Mexico, p. 5-7.

Baboshina, V.A., Tereshchenkov, A.A., and Kharakhinov, V.V., 1984, Deep structure of the Sea of Okhotsk region from geophysical data. Review of information: VNII Gasprom, v. 3, Moscow, 41 p. (in Russian).

Baboshina, V.A., Tereschenkov, A.A., and Kharakhinov, V.V., 1985, Gravitational field of the Sea of Okhotsk region and its interpretation in concert with bathymetry and seismic data: Tikhookeanskaya Geologiya, no. 6, p. 49-59 (in Russian).

Badredinov, Z.G., Taranin, I.A., Litvinov, A.F., Semenov, V.P., and Ivensen, V.Yu., 1989, On the nature of metamorphic rocks of the Khavyvensk Hills in Kamchatka: Doklady Akademii Nauk SSSR, v. 309, p. 405-409 (in Russian).

Bakharev, A.G., 1976, Stratigraphy and composition of the Ul'ya basin, *in* Volcanic and intrusive formations in Priokhot'e: Nauka, Novosibirsk, p. 53-75 (in Russian).

Bakharev, A.G., Gamyanin, G.N., Goryachev, N.A., and Polovinkin, V.L., 1988, Magmatic and ore formations of the Ulakhan-Tas Range: Academy of Sciences, Yakutsk, 200 p. (in Russian).

Baldwin, E.M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin, v. 83, 40 p.

Baranov B.V., Basov I.A., and Gladkikh P.A., 1984, Bedrock of the Shirshov Ridge: Okeanologiya, no. 24, p. 936-941 (in Russian).

Baranov B.V., Seliverstov N.I., Muravov A.V., Muzuzov E.L., 1991, The Komandorsky Basin as a product of spreading behind a transform plate boundary: Tectonophysics, v. 199, p. 237-269.

Bardoux, M., Irving, E., 1989, Paleomagnetism of Eocene rocks of the Kelowna and Castlegar areas, British Columbia: studies in determining paleohorizontal. Canadian Journal of Earth Sciences: v. 26, p. 829-844.

Barker, F., 1987, Cretaceous Chisana island arc of Wrangellia, eastern Alaska: Geological Society of America, Abstracts with Programs, v. 19, p. 580.

Barker, F., Miller, T.P., and Gehrels, G.E., 1994, Map showing major occurrences of accreted volcanic rocks and the pre-Cenozoic and some early Tertiary plutonic rocks of Alaska, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America, v. G1, plate 13, scale 1:2,500,000.

Barker, Fred, Jones, D.L., Budahn, J.R., and Coney, P.J., 1988, Ocean plateau-seamount origin of basaltic rocks, Angayucham terrane, central Alaska: Journal of Geology, v. 96, p. 368-374.

Barker, Fred, Sutherland Brown, A., Budahn, J.R., and Plafker, G., 1989, Back-arc with frontal arc component origin of Triassic Karmutsen basalt, British Columbia, Canada: Chemical Geology, v. 75, p. 81-102.

Bassett, K.N., 1991, Preliminary results of the sedimentology of the Skeena Group in west-central British Columbia, *in* Current Research, Part A: Geological Survey of Canada Paper 91-1A, p. 131-141.

Bazard, D.R., Butler, R.F., Gehrels, G.E., 1993, Paleomagnetic and detrital zircon analysis of the Lower Devonian Karheen Formation, Alexander Terrane, southeastern Alaska [abs.]: Supplement to Eos, Oct. 1993, p. 213.

Bazhenov, M.L., Burtman, V.S., 1994, Upper Cretaceous paleomagnetism of the Shikotan Island: A kinematic enigma: Earth and Planetary Science Letters, v. 122, p. 19-29.

Bazhenov, M.L., Burtman, V.S., Krezhovskikh, O.A., Shapiro, M.N., 1992, Paleomagnetism of Paleogene rocks of the Central-East Kamchatka and Komanorsky Islands: tectonic implications: Tectonophysics, v. 201, p. 157-173.

Bazhanov, V.A., and Oleinik, Yu. N., eds., 1986, Geological map of the Primorsk region: Primorsk Production and Geological Association, Vladivostok, 2 sheets, scale 1:1,000,000 (in Russian).

Beikman, H.M., 1980, Geologic map of Alaska: U.S. Geological Survey, scale 1:2,500,000.

Bekhtold A.F. and Semenov D.F., 1990, Metabasites and ultramafic rocks of the Susunai Ridge (Sakhalin Island): Tikhookeanskaya Geologiya, no. 1, p. 121-125 (in Russian).

Belyaeva, G.V., 1988, The Cambrian of the U.S.S.R. East: Stratigraphy: Nauka, Moscow, 136 p. (in Russian).

Belyi, V.F., 1977, Stratigraphy and structures of the Okhotsk-Chukotka volcanic belt: Nauka, Moscow, 171 p. (in Russian).

Belyi, V.F., 1978, Formations and tectonics of the Okhotsk-Chukotka volcanic belt: Nauka, Moscow, 213 p (in Russian).

Belyi, V.F., Kolyasnikov Yu. A., and Krasnyi, L.L., 1984, Stratigraphy of the Lower Paleozoic in the Penzhina Range, *in* Paleontology and Biostratigraphy of the Koryak Highland, Nauka, Moscow, p. 19-37 (in Russian).

Ben-Avraham, Z., and Cooper, A.K., 1981, Early evolution of the Bering Sea by collison of oceanic rises and north Pacific subduction zones: Geological Society of American Bulletin, v. 92, p. 485-495.

Berg, H.C., Elliott, R.L., and Koch, 1988, Geologic map of the Ketchikan and Prince Rupert quadrangles, southeastern Alaska: U.S. Geological Survey Miscellaneous Investigations Map I-1807, 2 sheets, 27 p.

Berg, H.C., Jones, D.L., and Coney, P.J., 1978, Pre-Cenozoic tectonostratigraphic terranes of southeastern Alaska and adjacent areas: U.S. Geological Survey Open-file Report 78-1085, 2 sheets, scale 1:1,000,000.

Berg, H.C., Jones, D.L., and Richter, D.H., 1972, Gravina-Nutzotin belt—Tectonic significance of an upper Mesozoic sedimentary and volcanic sequence in southern and southeastern Alaska, *in* Geological Survey research 1972: U.S. Geological Survey Professional Paper 800-D, p. D1-D24.

Bersenev, I.I.; ed., 1969, Geology of the U.S.S.R.: Nedra, Moscow, v. 23, 695 p. (in Russian).

Bersenev I.I., Lelikov E.P., Bezverkhny V.L., Vashchenkova N.G., S'edin V.G., Terekhov E.P., and Tsoi I.B., 1987, Geology of the Philippine Sea Floor: Far East Branch, U.S.S.R. Academy of Sciences, Vladivostok,. 138 p. (in Russian).

Besse, J., Courtillot, V., 1991, Revised and synthetic apparent polar wander paths of African, Eurasian, North American and Indian plates, and true polar wander since 200ma. Journal of Geophysical Research, v. 96, p. 4029-4050.

Beus, V.A., and Miledin, A.K., 1990, New data on the age of the metamorphic complex of the Prikolyma uplift: Doklady Akademii Nauk SSSR, v. 311, p. 925-928 (in Russian).

Bevier, M.L., 1988, Regional stratigraphy and age of Chilcotin Group basalts, south central Brtitish Columbia: Canadian Journal of Earth Sciences, v. 20, p. 515-524.

Bevier, M.L., and Anderson, R.G., 1991, Jurassic geochronometry in northwest Stikina (56-57°N), British Columbia [abs.]: Geological Society of America Abstracts with Programs, v. 23, p. A191.

Beyers, J.M., and Orchard, M.J., 1991, Late Permian and Triassic conondont faunas from the type-area of the Cache Creek Complex, south-central British Columbia: Geological Survey of Canada Bulletin 417, 52 p.

Bibikova, E.V., Makrov, V.A., Gracheva, T.V., and Kalinkina, O.M., 1981, Ancient rocks of the Omolon Massif, *in* Ancient Granitoids of the U.S.S.R.: Nauka, Leningrad, p. 137-146 (in Russian).

Bird, K.J., 1985, The framework geology of the North Slope of Alaska as related to oil-source rock correlations, *in* Magoon, L.B., and Claypool, G.E., eds., Alaskan North Slope oil/rock correlation study: American Association of Petroleum Geologists Studies in Geology, v. 20, p. 3-29.

Bird, K.J., 1988, Alaskan North Slope stratigraphic nomenclature and data summary for government-drilled wells: U.S. Geological Survey Professional Paper 1399, p. 317-353.

Bird, K.J., and Molenaar, C.M., 1987, Stratigraphy, Chap. 5, *in* Bird, K.J., and Magoon, L.B., eds., Petroleum geology of the northern part of the Arctic National Wildlife Refuge, northeastern Alaska: U.S. Geological Survey Bulletin 1778, p. 37-59.

Blodgett, R.B., 1992, Taxonomy and paleobiogeographic affinities of an early Middle Devonian (Eifelian) gastropod faunule from the Livengood quadrangle, east-central Alaska: Palaeontographica, pt. A, v. 221, p. 125-168.

Blodgett, R.B., and Clough, J.G., 1985, The Nixon Fork terrane - Part of an in-situ peninsular extension of the Paleozoic North American continent [abs.]: Geological Society of America Abstracts with Programs, v. 17, p. 342.

Blodgett, R.B., Clough, J.G., Dutro, J.T., Jr., Ormiston, A.R., Palmer, A.R., and Taylor, M.E., 1986, Age revisions for the Nanook Limestone and Katakturuk Dolomite, northeastern Brooks Range, *in* Bartsch-Winkler, Susan, and Reed, K.M., eds., Geologic studies in Alaska by the U.S. Geological Survey during 1985: U.S. Geological Survey Circular 978, p. 5-10.

Blodgett, R.B., Clough, J.G., Harris, A.G., and Robinson, M.S., 1992, The Mount Copleston Limestone, a new Lower Devonian formation in the Shublik Moutnains, northeastern Brooks Range, Alaska, *in* Bradley, D.S., and Ford, A.B., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1990: U.S. Geological Survey Bulletin 1999, p. 3-7.

Blodgett, R.B., and Gilbert, W.G., 1983, The Cheeneetnuk Limestone, a new Early(?) to Middle Devonian Formation in the McGrath A-4 and A-5 quadrangles, west-central Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 85, p. 1-6.

Blodgett, R.B., and Gilbert, W.G., 1992, Upper Devonian shallow-marine siliciclastic strata and associated fauna and flora, Lime Hills D-4 quadrangle, southwest Alaska, *in* Bradley, D.C., and Dusel-Bacon, Cynthia, eds., Geologic Studies in Alaska by the U.S. Geological Survey: U.S. Geological Survey Bulletin 2041, p. 106-113.

Blodgett, R.B., Rohr, D.M., Harris, A.G., and Rong, J.Y., 1988, A major unconformity between Upper Ordovician and Lower Devonian strata in the Nanook Limestone, Shublik Mountains, northeastern Brooks Range, *in* Galloway, J.P., and Hamilton, T.D., eds., Geologic studies in Alaska by the U.S. Geological Survey during 1987: U.S. Geological Survey Circular 1016, p. 18-23.

Blome, C.D., and Nestell, M.K., 1991, Evolution of a Permo-Triassic sedimentary mélange, Grindstone terrane, east-central Oregon: Geological Society of America Bulletin, v. 103, p. 1280-1296.

Blome, C.D., Reed, C.M., and Tailleur, I.L., 1988, Radiolarian biostratigraphy of the Otuk Formation in and near the National Petroleum Reserve in Alaska: U.S. Geological Survey Professional Paper 1399, p. 725-792.

Boak, J.M., Turner, D.L., Henry, D.J., Moore, T.E., and Wallace, W.K., 1987, Petrology and K-Ar ages of the Misheguk igneous sequence, an allochthonous mafic and ultramafic complex, and its metamorphic aureole, western Brooks Range, Alaska, *in* Tailleur, I.L., and Weimer, Paul, eds., Alaskan North Slope Geology: Los Angeles, Society of Economic Paleontologists and Mineralogists, Pacific Section, and Anchorage Alaska Geological Society, v. 2, p. 737-745.

Bogdanov N.A., and Neprochnov, 1984, Geology of the Bering Sea deep basin, *in* Origin and history of the marginal and inland seas: Proceedings 27th International Geological Congress, VNU Science Press, Utrecht, v. 27, p. 1-17.

Bogdanov N.A., Vishnevskaya V.S., Suchov A.N., 1983, Upper Cretaceous deposits from the Shirshov Ridge (Bering Sea): Doklady Akademii Nauk SSSR, v. 273: 1183-1187 (in Russian).

Bogdanov, N.A., Vishnevskaya, V.S. Kepezhinskas, P.K., Sukhov, A.N., and Fedorchuk, A.V., 1987, Geology of the southern Koryak Highland: Nauka, Moscow, 168 p. (in Russian).

Bol, A.J., 1993, Overprint magnetization in support of northward displacement of the Chugach-Prince William Terrane, Alaska. Journal of Geophysical Research, v. 98, p. 22,389-22,400.

Bol, A.J., Coe, R.S., Gromme, C.S., Hillhouse, J.W., 1992, Paleomagnetism of the Resurrection Peninsula, Alaska: Impications for the tectonics of southern Alaska and the Kula-Faralon Ridge. Journal of Geophysical Research, v. 97, p. 17,213-17,232.

Bondarenko, G.E., and Sokolkov, V.A., 1990, New data on the age, structure and formation conditions of the volcanogenic siliceous-carbonate complex in Omgon Cape (West Kamchatka): Doklady Akademii Nauk SSSR, v. 315, no. 6, p. 1434-1437 (in Russian).

Borzunova, G.P., Seliverstov, V.A., Khotin, M.Yu, and Shapiro, M.N., 1969, The Paleogene of Kamchatka Cape: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 7, p. 102-109 (in Russian).

Box, S.E., 1985a, Early Cretaceous orogenic belt in northwestern Alaska: Internal organization, lateral extent, and tectonic interpretation, *in* Howell, D.G., ed., Tectonostratigraphic terranes of the Circum-Pacific region: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, v. 1, p. 137-145.

Box, S.E., 1985b, Geologic setting of high-pressure metamorphic rocks, Cape Newenham area, southwestern Alaska, *in* Bartsch-Winkler, Susan, ed., The United States Geological Survey in Alaska: Accomplishments during 1984: U.S. Geological Survey Circular 967, p. 37-42.

Box, S.E., 1985c, Terrane analysis, northern Bristol Bay region, southwestern Alaska, *in* Bartsch-Winkler, Susan, ed., The United States Geological Survey in Alaska: Accomplishments during 1984: U.S. Geological Survey Circular 967, p. 32-36.

Box, S.E., and Elder, W.P., 1992, Depositional and biostratigraphic framework of the Upper Cretaceous Kuskokwim Group, southwestern, Alaska, *in* Bradley, D.C., and Ford, A.B., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1990: U.S. Geological Survey Bulletin 1999, p. 8-16.

Box, S.E., Moll-Stalcup, E.J., and Wooden, J.L., 1990, Kilbuck terrane: Oldest-known rocks in Alaska: Geology, v. 18, p. 1219-1222.

Box, S.E., Moll-Stalcup, E.J., Frost, T.P., and Murphy, J.M., 1993, Preliminary geologic map of the Bethel and southern Russian Mission quadrangles, southwestern Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-2226-A, scale 1: 250,000, 20 p.

Box, S.E., and Patton, W.W., Jr., 1989, Igneous history of the Koyukuk terrane, western Alaska: Constraints on the origin, evolution, and ultimate collision of an accreted island arc terrane: Journal of Geophysical Research, v. 94, p. 15,843-15,867.

Brabb, E.E., and Churkin, Michael, Jr., 1969, Geologic map of the Charley River quadrangle, east-central Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-573, 1 sheet, scale 1: 250,000.

Bradley, D.C., and Kusky, T.M., 1992, Deformation history of the McHugh Complex, Seldovia quadrangle, south-central Alaska, *in* Bradley, D.C., and Ford, A.B., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1990: U.S. Geological Survey Bulletin 1999, p. 17-32.

Bragin, N.Yu., 1991, Carian complex of radiolaria of silicic volcanogenic sequences of the Ekonay zone of the Koryak Highland: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 6, p. 79-86 (in Russian).

Brandon, M. T., 1989, Geology of the San Juan-Cascade Nappes, Northwestern Cascade Range and San Juan Islands: in Joseph, N. L., and others, eds., Geologic guidebook for Washington and adjacent areas: Washington Division of Geology and Earth Resources Information Circular 86, p. 137-162.

Brandon, M.T., 1989, Deformation styles in a sequence of olistostromal melanges, Pacific Rim Complex, western Vancouver Island, Canada: Geological Society of America Bulletin, v. 101, p. 1520-1542.

Brandon, M.T., Cowan, D.S. and Vance, J.A., 1988, The Late Cretaceous San Juan thrust system, San Juan Islands, Washington: Geological Society of America Special Paper., 221, 81 p.

Brandon, M.T., Cowan, D.S., and Vance, J.A., 1988, The Late Cretaceous San Juan Thrust system, San Juan Islands, Geological Society of America Special Paper 221, 81 p.

Brew, D.A., 1988, Latest Mesozoic and Cenozoic igneous rocks of southeastern Alaska--a synopsis: U.S. Geological Survey Open-File Report 88-405, 52 p.

Brew, D.A., 1994, Latest Mesozoic and Cenozoic magmatism in southeastern Alaska, *in* Plafker, George, and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, v. G1, p. 621-656.

Brew, D.A., and Karl, S.M., 1988a, A reexamination of the contacts and other features of the Gravina Belt, southeastern Alaska [abs]: Geological Society of America Abstracts with Programs, v. 20, p. 111.

Brew, D.A., and Karl, S.M., 1988b, A reexamination of the contacts and other features of the Gravina belt, southeastern Alaska, *in* Galloway, J.P., and Hamilton, T.D., eds., Geologic studies in Alaska by the U.S. Geological Survey during 1987: U.S. Geological Survey Circular 1016, p. 143-146.

Brew, D.A., and Karl, S.M., 1988c, A reexamination of the contacts and other features of the Gravina belt, southeastern Alaska, Supplemental data: U.S. Geological Survey Open-File Report 88-652, 8 p.

Brew, D.A., Karl, S.M., and Miller, J.W., 1988, Megafossils (Buchia) indicate Late Jurassic age for part of Kelp Bay Group on Baranof Island, southeastern Alaska, *in* Galloway, J.P., and Hamilton, T.D., eds., Geologic studies in Alaska by the U.S. Geological Survey during 1987: U.S. Geological Survey Circular 1016, p. 147-149.

Brew, D.A., Karl, S.M., Barnes, D.F., Jachens, R.C., Ford, A.B., and Horner, R., 1991, A northern Cordilleran ocean-continent transect: Sitka Sound to Atlin Lake, British Columbia: Canadian Journal of Earth Sciences, v. 28, p. 840-853.

Brew, D.A., Ovenshine, A.T., Karl, S.M., and Hunt, S.J., 1984, Preliminary reconnaissance geologic map of the Petersburg and parts of the Port Alexander and Sumdum 1:250,000 quadrangles, southeastern Alaska: U.S. Geological Survey Open-File Report 84-405, 2 sheets, 43 p.

Brewer, W.M., 1982, Stratigraphy, structure, and metamorphism of the Mount Deborah area, central Alaska Range, Alaska: unpublished Ph.D. thesis, University of Wisconsin, Madison, 318 p.

Brooks, H.C., 1979, Geologic map of the Huntington and part of the Olds Ferry quadrangles, Baker and Malheur Counties, Oregon: Oregon Department of Geology and Mineral Industries Geological Map Series GMS-35, scale 1:62,500.

Brooks, H.C., and Vallier, T.L., 1978, Mesozoic rocks and tectonic evolution of eastern Oregon and western Idaho, *in* Howell, D.G., and McDougall, K.A., eds., Mesozoic paleogeography of the Western United States (Pacific Coast Paleogeography Symposium 2): Los Angeles: Society of Economic Paleontologists and Mineralogists, Pacific Section, p. 133-145.

Brosgé, W.P., Dutro, J.T., Jr., Mangus, M.D., and Reiser, H.N., 1962, Paleozoic sequence in eastern Brooks Range, Alaska: American Association Petroleum Geologists Bulletin, v. 46, p. 2,174-2,198.

Brosgé, W.P., Lanphere, M.A., Reiser, H.N., and Chapman, R.M., 1969, Probable Permian age of the Rampart Group, central Alaska: U.S. Geological Survey Bulletin 1294-B, 18 p.

Brosgé, W.P., and Reiser, H.N., 1969, Preliminary geologic map of the Coleen quadrangle, Alaska: U.S. Geological Survey Open-File Report OF 69-370, 1 sheet, scale 1:63,360.

Brosgé, W.P., and Tailleur, I.L., 1970, Depositional history of northern Alaska, *in* Adkison, W.L., and Brosgé, M.M., eds., Proceedings of the geological seminar on the North Slope of Alaska: American Association of Petroleum Geologics Pacific Section Meeting, Los Angeles, p. D1-D18.

Brown, D.A., Logan, J.M., Gunning, M.H., Orchard, M.J., and Bamber, W.E., 1991, Stratigraphic evolution of the Paleozoic Stikine assemblage in the Stikine and Iskut rivers areas, northwestern British Columbia: Canadian Journal of Earth Sciences, v.28, p. 958-972.

Brown, E.H., 1986, Geology of the Shuksan suite, North Cascades, Washington, U.S.A., *in* Evans B. W. and Brown, E. H., eds., Blueschists and eclogites: Geological Society of America Memoir, 164, p. 143-154.

Brown, E.H., 1987, Structural geology and accretionary history of the Northwest Cascade System, Washington and British Columbia: Geological Society of America Bulletin, v. 99, p. 201-214.

Brown, E.H., Blackwell, D.L., Christianson, B.W., Frasse, F.I., Huagerud, R.A., Jones, J.T., Leiggi, P.A., Morrison, M.L., Rady, P.M., Reller, G.J., Sevigny, J.H., Silverberg, D.S., Smith, M.T., Sondergaard, J.N., and Zeigler, C.B., 1986, Geologic map of the Northwest Cascades, Washington: Geological Society of America Map and Chart Series, MC-61, scale 1:100,000.

Brown, E.H. and Vance, J.A., 1987, Correlation of pre-Tertiary thrust structures between the San Juan Islands and Northwest Cascades, Washington [abs.]: Geological Society of America Abstracts with Programs, v. 19, p. 362.

Brown, R.L., Journeay, J.M., Lane, L.S., Murphy, D.C., and Rees, C.J., 1986, Obduction, backfolding and piggyback thrusting in the metamorphic hinterland of the Canadian Cordillera: Journal of Structural Geology, v. 8, p.225-268.

Brudnitskaya, E.P., 1990, New data on stratigraphy of Triassic deposits of the Lânsk subzone of the Uda structural-formational zone, *in* Precambrian and Phanerozoic stratigraphy of the Transbaikal Region and the Southern Far East: Abstracts of the 14th Far East Regional Interdepartment Stratigraphic Meeting, Khabarovsk, p. 141-142 (in Russian).

Bulgakova, M.D., 1986, Lithology of Ordovician deposits in Northeastern U.S.S.R.: Nauka, Moscow, 177 p. (in Russian).

Bulgakova, M.D., Korobitsyn, A.V., Semenov, V.P., and Ivensen, V.Yu., 1979, Sedimentary and volcanic-sedimentary formations of Verkhoyansk: Nauka, Novosibirsk, 133 p. (in Russian).

Bundtzen, T.K., and Gilbert, W.G., 1983, Outline of the geology and mineral resources of the upper Kuskokwim region, southwest Alaska, *in* Sisson, Alex, ed., Symposium on energy and mineral resoutces of western Alaska: Alaska Geological Society, v. 3, p. 98-119.

Burns, L.E., 1985, The Border Ranges ultramafic and mafic complex, south-central Alaska: Cumulate fractionates of island-arc volcanics: Canadian Journal of Earth Sciences, v. 22, p. 1020-1038.

Butler, R.F., Harms, T.A., Gabrielse, H., 1988, Cretaceous remagnetization in the Sylvester Allochthon: limits to post-105Ma northward displacement of north-central British Columbia. Canadian Journal of Earth Sciences, v. 25, p. 1316-1322.

Byalobzheskiy, S.G., Korago, E.A., Lychagin, P.P., Kolyasnikov, Yu A., and Likman, V.B., 1990, South Anyui zone: Long-lived development of folded structure, *in* Tectonics and Metallogeny of U.S.S.R. Northeast: U.S.S.R. Academy of Sciences, Magadan, p. 29-31 (in Russian).

Byalobzhesky, S.G., Kolyasnikov, Y.A., and Schmakin, V.B., Tectonics of the active continental margin (Koyrak Upland): Northeast Scientific Research Institute, U.S.S.R. Academy of Sciences, Magadan, 246 p. (in Russian).

Bychkov, Yu.M., 1991, Comparison of the characteristics of the Triassic of northern Chukotka and the northern Yukon deposits, *in* Geology of folded rim of the Amerasian sub-basin: NPO Sevmorgeologiya, St. Petersburg, p. 84-93 (in Russian).

Bychkov, Yu.M., Byalobzhesky, S.G., and Petrov, A.N., 1990, First findings of Early and Middle Jurassic fauna in the eastern Koryak Highland: Doklady Akademii Nauk SSSR, v. 312, p. 1181-1189 (in Russian).

Bychkov, Yu.M., and Kiseleva, L.S., 1990, Local subidvisions of the Triassic in the upper Kolyma, Yana, and Tauy Rivers: U.S.S.R. Academy of Sciences, Magadan, 55 p. (in Russian).

Bychkov, Yu.M., and Solov'ev, G.I., 1991, New data on the stratigraphy and lithology of Triassic deposits of the Bol'shoy Anyui River, *in* Pokhialainen, V.P., ed., Lower Mesozoic of the right bank of the Kolyma River: SVKNII, Ministry of Geology, Magadan, p. 3-24 (in Russian).

Cady, W.M., 1975, Tectonic setting of the Tertiary volcanic rocks of the Olympic Peninsula, Washington: U.S. Geological Survey Journal of Research, v. 3, n. 5, p. 573-582.

Cady, W.M., Wallace, R.E., Hoare, J.M., and Webber, E.J., 1955, The central Kuskokwim region, Alaska: U.S. Geological Survey Professional Paper 268, 132 p.

Cairnes, C.E., 1944, Hope Sheet, British Columbia: Geological Survey of Canada Map 737A, scale 1:200,000.

Campbell, Russell H., 1967, Areal geology in the vicinity of the Chariot Site, Lisburne Peninsula, northwestern Alaska: U.S. Geological Survey Professional Paper 395, 71 p.

Campbell, R.B., and Dodds, C.J., 1982a, Geology of S.W. Kluane Lake map area, Yukon Territory: Geological Survey of Canada Maps 115F and 115G, Open File 829, scale 1:250,000.

Campbell, R.B., and Dodds, C.J., 1982b, Geology of the Mount St. Elias map area, Yukon Territory: Geological Survey of Canada Maps 115B and 115C, Open File 830, scale 1:250,000.

Carter, E.S., Orchard, M.J., Ross, C.A., Ross, J.R.P., Smith, P.L., and Tipper, H.W., 1992, Paleontological signatures of terranes; in Gabrielse, H., and Yorath, C.J., eds., Geology of the Cordilleran Orogen in Canada, Part B: Geological Society of America, The Geology of North America, v. G-2, p. 28-28.

Cecile, M.P., Harrison, J.C., Kos'ko, M.K., and Parrish, R.R., 1991, Precambrian U-Pb ages of igneous rocks, Wrangell Complex, Wrangell Island, U.S.S.R.: Canadian Journal of Earth Sciences, v. 28, p. 1340-1348.

Chapman, R.M., Weber, F.R., and Taber, Bond, 1971, Preliminary geologic map of the Livengood quadrangle, Alaska: U.S. Geological Survey Open-File Report 71-66, 1 sheet, scale 1:250,000.

Chekhov, A.D., 1982, Tectonics of the Talov-Pekul'ney Zone, *in* Pushcharovskiy, Yu.M., and Til'man, S.M., eds, Essays on tectonics: Nauka, Moscow, p. 70-106 (in Russian).

Chikov, B.M., 1978, Median massifs and problems of tectonic zoning of orogenic belts: Nauka, Novosibirsk, 249 p. (in Russian).

Churkin, Michael, Jr., 1973, Geological concepts of Arctic Ocean basin, *in* Pitcher, M.G., ed., Arctic geology: American Association of Petroleum Geologists Memoir 19, p. 485-499.

Churkin, Michael, Jr., Carter, Claire, and Trexler, J.H., Jr., 1980, Collision-deformed Paleozoic continental margin of Alaska--foundation for microplate accretion: Geological Society of America Bulletin, v. 91, p. 648-654.

Churkin, Michael, Jr., Foster, H.L, Chapman, R.M., and Weber, F.R., 1982, Terranes and suture zones in east central Alaska: Journal of Geophysical Research, v. 87, p. 3718-3730.

Churkin, Michael, Jr., Nokleberg, W.J., and Huie, Carl, 1979, Collision-deformed Paleozoic continental margin, western Brooks Range, Alaska: Geology, v. 7, p. 379-383.

Clough, J.G., and Blodgett, R.B., 1985, Comparative study of the sedimentology and paleoecology of middle Paleozoic algal and coral-stromatoporoid reefs in Alaska: Proceedings of the Fifth International Coral Reef Congress, Tahiti, v. 3, p. 184-190.

Clowes, R.M., Brandon, M.T., Green, A.G., Yorath, C.J., Sutherland Brown, A., Kanasewich, E.R. and Spencer, C., 1987, LITHOPROBE--Southern Vancouver Island: Cenozoic subduction complex imaged by deep seismic reflections: Canadian Journal of Earth Sciences, v. 24, p. 31-51.

Cluzel, D., 1990, Geodynamics of the Ogcheon Belt, South Korea: Tectonophysics, v, 183, p. 41-56.

Cluzel, D., 1991, Late Paleozoic to early Mesozoic geodynamic evolution of the Circum-Pacific orogenic belt in Korea and Southwest Japan: Earth and Planetary Science Letters, v. 108, p. 289-305.

Cluzel, D., Lee, B.-J., and Cadet, J.-P., 1991, Indonesian dextral-ductile fault system and synkinematic plutonism in the southwestern Ogcheon belt, South Korea: Tectonophysics, v. 194, p. 131-151.

Coe, R.S., Globerman, B.R. Plumley, P.W., and Thrupp, G.A., 1985, Paleomagnetic results from Alaska and their tectonic implications, *in* D.G.Howell, ed, Tectonostratigraphic Terranes of the Circum Pacific Region: Earth Science Series1: Circum-Pacific Council for Energy and Mineral Resources, Houston, Texas, p. 85-108.

Cohen, H.A., and Lundberg, N.L., 1993, Detrial record of the Gravina arc, southeastern Alaska: Petrology and provenance of Seymour Canal Sandstones: Geological Society of America Bulletin, v. 105, p. 1400-1414.

Coney, P.J., Jones, D.L., and Monger, J.W.H., 1980, Cordilleran suspect terranes: Nature, v. 288, p. 329-333.

Connelly, William, 1978, Uyak Complex, Kodiak Islands, Alaska: A Cretaceous subduction complex: Geological Society of America Bulletin, v. 89, p. 775-769.

Connelly, William, and Moore, J.C., 1979, Geologic map of the northwest side of the Kodiak and adjacent islands, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1047, 2 sheets, scale 1:250,000.

Cooper, A.K., Scholl, D.W., and Marlow, M.S., 1987, Structural framework, sedimentary sequences, and hydrocarbon potential of the Aleutian and Bowers Basins, Bering Sea, *in* Scholl, D.W., Grantz, A., and Vedder, J.G. eds., Geology and resource potential of the continental margin of Western North America and adjacent ocean basins--Beaufort Sea to Baja California: Earth Science Series, Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, v. 6, p. 473-502.

Cooper, A.K., Scholl, D.W., and Marlow, M.S., 1992, Evidence for Cenozoic crustal extension in the Bering Sea region: Tectonics, v. 11, p. 719-731.

Cordey, F., Mortimer, N., De Wever, P., and Monger, J.W.H., 1987, Significance of Jurassic radiolarians from the Cache Creek terrane, British Columbia: Geology, v. 15, p.1151-1154.

Cordey, F., and Schiarizza, P.F., 1993, Long-lived Panthalassic remnant: the Bridge River accretionary complex, Geology, v. 21, p. 263-266.

Cormier V.F., 1985. Tectonics near the junction of the Aleutian and Kuril-Kamchatka area and a mechanism for middle Tertiary magmatism in the Kamchatka Basin: Geological Society of America Bulletin, v. 86, p. 443-353.

Cowan, D.S. and Miller, R.B., 1980, Deformational styles in two Mesozoic fault zones, western Washington, U.S.A.: Geological Society of London Special Publication, no. 9, 8 p.

Crawford, M.L., Hollister, L.S., and Woodsworth, G.J., 1987, Crustal deformation and regional metamorphism across a terrane boundary: Tectonics, v. 6, p. 343-361.

Csejtey, Béla, Jr., Mullen, M.W., Cox, D.P., Gilbert, W.G., Yeend, W.E., Smith. T.E., Wahrhaftig, Clyde, Craddock, Campbell, Brewer, W.M., Sherwood, K.W., Hickman, R.B., Stricker, G.D., St. Aubin, D.R., and Goerz, D.J., III., 1986, Geology and geochronology of the Healy quadrangle, Alaska: U.S. Geological Survey Open-File Report 86-396, 4 sheets, scale 1:250,000, 86 p.

Currie, L., and Parrish, R.R., 1993, Jurassic accretion of Nisling terrane along the western margin of Stikinia, Coast Mountains, northwestern British Columbia: Geology, v.21, p. 235-238.

Dagis, A.S., Arkhipov, Yu.U., and Bychkov, Yu.M., 1979, Stratigraphy of the Triassic system in northeastern Asia: Nauka, Moscow, 243, p (in Russian).

Daly, R.A., 1912, Geology of the North American Cordillera at the 49th parallel: Geological Survey of Canada Memoir 38, 857 p.

Danilov, V.P., and Stavskiy, A.P., 1984, Stratigraphy and lithology of the Uyandina-Yasachnaya volcanic belt: Moskovogo Obshchestva Ispytatelei Prirody Byulletin', Otdel Geologicheskii, no. 1, p. 44-56 (in Russian).

Davidson, Cameron, and Hollister, L.S., 1992, Role of melt in the formation of a deep-crustal compressive shear zone: The Maclaren Glacier metamorphic belt, south-central Alaska: Tectonics, v. 11, p. 348-359.

Decker, J.E., Jr., Bergman, S.C., Blodgett, R.B., Box, S.E., Bundtzen, T.K., Clough, J.G., Coonrad, W.L., Gilbert, W.G., Miller M.L., Murphy, J.M., Robinson, M.S., and Wallace, W.K., 1994, Geology of southwestern Alaska, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America, v. G1, p. 285-310.

Decker, John, Wilson, F.H., and Turner, D.L., 1980, Mid-Cretaceous subduction event in southeastern Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 12, p. 103.

Denisova, T.A., 1977, Composition of Merkushevsk conglomerate and early Paleozoic formations in the Khanka Massif, *in* Zimin, S.S., ed., Geology and Magmatism of the Far East: Far Eastern Science Center, U.S.S.R. Academy of Sciences, Vladivostok, p. 25-28 (in Russian).

Detterman, R.L., Miller, J.W., Case, J.E., Wilson, F.H., and Yount, M.E., in press, Stratigraphic framework of the Alaska Peninsula: U.S. Geological Survey Bulletin 1969-A.

Dickinson, W.R., 1979, Mesozoic fore-arc basin in central Oregon: Geology, v. 7, p. 166-170.

Dickinson, W.R., and Thayer, T.P, 1978, Paleogeographic and paleotectonic implications of Mesozoic stratigraphy and structure in the John Day inlier of central Oregon, *in* Howell, D.G., and McDougall, K.A., eds., Mesozoic paleogeography of the Western United States: Society of Economic Paleontologists and Mineralogists, Pacific Section, p. 147-161.

Didenko, A., Harbert, W., and Stavsky, A., 1993, Paleomagnetism of Khatyrian and Mayinsky terranes, Koryakian Highlands, northeast CIS: Tectonophysics, v. 220, p. 141-156

Dillon, J.T., 1989, Structure and stratigraphy of the southern Brooks Range and northern Koyukuk basin near the Dalton Highway, *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska:Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 157-187.

Dillon, J.T., Harris, A.G., and Durtro, J.R., Jr., 1987, Preliminary description and correlation of lower Paleozoic fossil-bearing strata in the Snowden Mountain area of the south-central Brooks Range, Alaska, *in* Taillerur, I.L., and Weimer, Paul, eds., Alaskan North Slope Geology: Pacific Section, Society of Economic Paleontologists and Mineralogists, v. 50, p. 337-345.

Dillon, J.T., Pessel, G.H., Chen, J.H., and Veach, N.C., 1980, Middle Paleozoic magmatism and orogenesis in the Brooks Range, Alaska: Geology, v. 8, p. 338-343.

Dobretsov N.L., 1978. Glaucophane schist and eclogite-glaucophane schist units of the U.S.S.R.. Nauka, Novosibirsk, 430 p. (in Russian).

Dobretsov, N.L., Watanabe, T., Natal'in, B. and Miashita, S., in press, Comparison of ophiolites and blueschists of Sakhalin and Hokkaido: Ofioliti.

Dolgov, B.Yu., Natapov, L.M., and Stavsky, A.P., 1983, The Tas-Khayakhtakh Range ophiolites: Doklady Akademii Nauk SSSR, v. 268, p. 666-668 (in Russian).

Dover, J.H., 1990, Geology of east-central Alaska: U.S. Geological Survey Open-File Report 90-289, 96p.

Dovgal', Yu.M., 1964, Ophiolitic formations of the Aluchin uplift, *in* Materials on geology and mineral deposits of the U.S.S.R. Northeast: U.S.S.R. Academy of Sciences, Magadan, v. 17, p 149-158 (in Russian).

Dovgal', Yu.M., Gorodinsky, M.E., and Sterligova, V.E., 1975, Aluchin ultramafic massif: Magmatism of Northeast Asia, U.S.S.R. Academy of Sciences, Magadan, p. 59-70 (in Russian).

Dovgal', Yu.M. and Palymskiy, B.F., 1972, Formation of South Anyui basin: Materials on geology and mineral deposits of U.S.S.R. Northeast: U.S.S.R. Academy of Sciences, Magadan, v. 20, p. 152-161 (in Russian).

Drabkin, I.E., 1970, ed., Geology of the U.S.S.R., U.S.S.R. Northeast: Nedra, Moscow, v. 30, Northeast USSR, book 1: Nedra, Moscow, 501 p. (in Russian).

Drachev, S.S., 1989, Tectonic and Mesozoic geodynamics of the New Siberian Island region: Summary of Candidate of Science thesis, U.S.S.R. Academy of Sciences, Moscow, 19 p. (in Russian).

Drachev, S.S., and Savostin, L.A., 1992, Dismembered ophiolitic association of the New Siberian Islands: Structural setting, composition, and interpretation [abs.]: International Conference on Arctic Margins Program with Abstracts, Anchorage, p. 14.

Drachev, S.S., and Savostin, L.A., 1993, Ophiolites of Bol'shoi Lyakhov Island (Novosibirsk Islands): Geotektonika, no. 3, p. 98-107 (in Russian).

Dudko, E.A., and Spektor, V.B., 1989, Northwestern continuation of the South Anyui fold zone in the lower reaches of the Kolyma (according to gravimetric and magnetometric data): Geologiya i Geofizika, no. 2, p. 21-31 (in Russian).

Dumoulin, J.A., 1987, Sandstone composition of the Valdez and Orca Groups, Prince William Sound, Alaska: U.S. Geological Survey Bulletin 1774, 37 p.

Dumoulin, J.A., 1988, Sandstone petrographic evidence and the Chugach-Prince William terrane boundary in southern Alaska: Geology, v. 16, p. 456-460.

Dumoulin, J.A., and Harris, A.G., 1987, Lower Paleozoic carbonate rocks of the Baird Mountains quadrangle, western Brooks Range, Alaska, *in* Tailleur, I.L., and Weimer, Paul, eds., Alaska North Slope Geology: Pacific Section, Society of Economic Paleontologists and Mineralogists, v. 50, p. 311-336.

Duncan, R.A., and Kulm, L.D., 1989, Plate tectonic evolution of the Cascades arc-subduction complex, *in* Winterer, E.L., Hussong, D.M., and Decker, R.W., eds., The eastern Pacific Ocean and Hawaii: Geological Society of America, Geology of North America, v. N, p. 413-438.

Dusel-Bacon, Cynthia, 1991, Metamorphic history of Alaska: U.S. Geological Survey Open-File Report 91-556, 48 p., 2 sheets, scale 1:2,500,000.

Dusel-Bacon, Cynthia, Doyle, E.O., and Box, S.E., in press, Distribution, facies, ages, and proposed tectonic associations of regionally metamorphosed rocks in southwestern Alaska and the Alaska Peninsula: U.S. Geological Survey Professional Paper 1497-B, __ p., 1 sheet, scale 1:1,000,000.

Dusel-Bacon, Cynthia and Hansen, V.L., 1992, High-pressure, amphibolite-facies metamorphism and deformation within the Yukon-Tanana and Taylor Mountain terranes, eastern Alaska, *in* Bradley, D.C., and Dusel-Bacon, Cynthia, eds, Geological Studies in Alaska by the U.S. Geological Survey, 1991: U.S. Geological Survey Bulletin 2041, p. 140-159.

Dutro, J.T., Jr., Brosgé, W.P., Lanphere, M.A., and Reiser, H.N., 1976, Geologic significance of Doonerak structural high, central Brooks Range, Alaska: American Association of Petroleum Geologists Bulletin, v. 60, p. 952-961.

Duttweiler-Kelley, Karen, 1990, Interpretation of geochemical data from Admiralty Island, Alaska--Evidence for volcanogenic massive sulfide mineralization, *in* Goldfarb, R.J., Nash, T.J., and Stoerer, J.W., eds., Geochemical Studies in Alaska by the U.S. Geological Survey, 1989: U.S. Geological Survey Bulletin 1950, p. A1-A9.

Dylevsky, E.F., 1990, New data on pre-late Mesozoic magmatism of the Rassoshina zone of the Omulevka uplift: Geologiya i Geofizika, no. 6, p 72-77 (in Russian).

Dylevsky, E.F., 1992, Magmatism of the Siversk uplift (Northeastern U.S.S.R.): Tikhookeanskaya Geologiya, no. 2, p. 95-104 (in Russian).

Eberlein, G.D., Churkin, M., Jr., Carter, C., Berg, H.C., and Ovenshine, A.T., 1983, Geology of the Craig quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-91, 4 sheets, scale 1:250,000, 53 p.

Eisbacher, G.H. 1974, Evolution of sedimentary basins in the Canadian Cordillera, *in* Dott, R.H., Jr., and Shaver, R.H., eds., Modern and Ancient Geosynclinal Sedimentation: Society of Economic Paleontologists and Mineralogists Special Publication 19, p. 274-291.

Eittreim, S., Grantz, A., and Whitney, O. T., 1979, Cenozoic sedimentation and tectonics of Hope Basin, southern Chukchi Sea, *in* Sisson, Alex, ed., The relationship of plate tectonics to Alaskan geology and resources: Alaska Geological Society, Anchorage, p. B-1-B-11.

Engebretson, D.C., Cox, A., and Gordon, R.G., 1985, Relative motions between oceanic and continental plates in the Pacific Basin, Geological Society of America, Special Paper 206, 59 p.

England, T.J.E., and Calon, T.J., 1991, The Cowichan fold and thrust system, Vancouver Island, southwestern British Columbia, Geological Society of America Bulletin, v. 103, p. 336-362.

Epstein, O.G., 1977, Sources of drift material in the development history of the Verkhoyansk Complex, southern part of Yana-Kolyma folded area: Materials on the geology and mineral resources of the U.S.S.R. Northeast, U.S.S.R. Academy of Sciences, Magadan, v. 23, p. 110-113 (in Russian).

Erdmer, Paul, and Armstrong, R.L., 1988, Permo-Triassic isotopic dates for blueschist, Ross River area, Yukon: Yukon Geology, v. 2, Canadian Department of Indian and Northern Affairs, Whitehorse, p. 33-36.

Erlikh, E.N., 1973, Modern structure and Quaternary volcanism of the western Pacific realm: Nauka, Novosibirsk, 242 p. (in Russian).

Ermakov, B.V., 1975, Ukelayat-Shumagin flysch basin in Koryakia and southern Alaska: Geologiya i Geofizika, no. 6, p. 42-46 (in Russian).

Evans, B.W., and Berti, J., 1986, A revised metamorphic history for the Chiwaukum Schist, Washington Cascades, Geology, v. 14, p. 695-698.

Evenchick, C.A., 1991a, Structural relationships of the Skeena Fold Belt west of the Bowser Basin, northwest British Columbia: Canadian Journal of Earth Sciences, v. 28, p. 973-983.

Evenchick, C.A., 1991b, Geometry, evolution, and tectonic framework of the Skeena Fold Belt, north central British Columbia, Tectonics, v.10, p. 527-546.

Evlanov, Yu.B., 1971, On role of volcanism in formation of Paleozoic geosyncline series in the Tumanchan-Suifunsk fold belt, *in* Kireeva, E.A., and Ignatova, V.F., eds., Lithology and geochemistry of volcanogenic-sedimentary formations of the southern Far East: Far Eastern Science Center, U.S.S.R. Academy of Sciences, Vladivostok, p. 5-18 (in Russian).

Ewing, T.E., 1980, Paleogene tectonic evolution of the Pacific Northwest: Journal of Geology, v. 88, p. 619-638.

Faure, M. 1986. The Late Jurassic oblique collisional orogen of southwestern Japan. New structural data and synthesis: Tectonics, v. 5, 1089-1114.

Faure, M., and Natal'in, B., 1992, The geodynamic evolution of the eastern Eurasian margin in Mesozoic times: Tectonophysics, v. 208, p. 397-411.

Farmer, G.L., Ayuso, Robert, and Plafker, George, 1993, A Coast Mountains provenance for the Valdez and Orca groups, southern Alaska, based on Nd, Sr, and Pb isotopic evidence: Earth and Planetary Science Letters, v. 116, p. 9-21.

Fedorchuk, A.V., Peyve, A.A., Gul'ko, N.I., and Savichev A.T., 1989, Petrochemical types of basalts of the ophiolite assemblage in Kamchatka Cape: Geokhimiya, no. 12, 1710-1717 (in Russian).

Fedorchuk, A.V., Tsukanov, N.V., Efremova, L.B., and Savichev, A.T., 1990, Oceanic magmatism of the Kumroch Range (Eastern Kamchatka): Geokhimiya, no. 12, p. 1721-1729 (in Russian).

Fedorchuk, A.V., Vishnevskaya, V.S., Izvekov, I.N., and Rumyantseva, Yu.S., 1989, New data on structure and age of siliceous-volcanogenic rocks of Kamchatka Cape (Eastern Kamchatka): Geologiya i Razvedka, no. 11, p. 27-33 (in Russian).

Fernette, Gregory, and Cleveland, Gregory, 1984, Geology of the Miss Molly molybdenum propsect, Toyonek C-6 quadrangle, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 86, p. 35-41.

Ferns, M.L., and Brook, H.C., in press, The Bourne and Greenhorn subterranes, subdivisions of the Baker terrane: Implications for the evolution of the Blue Mountains island arc system, *in* Vallier, T.L., and Brooks, H.C., eds., The geology of the Blue Mountains region of Oregon, Idaho, and Washington: Petrology and tectonic evolution of pre-Tertiary rocks: U.S. Geological Survey Professional Paper 1438, Ch. 9.

Filatova, N.I., 1979, Cretaceous-Paleogene volcanism of the transition zone between the Verhoyansk-Chukotka and Koryak-Kamchatka regions: Geotektonika, no. 5, p. 67-82 (in Russian)

Filatova, N.T., 1988, Circum-oceanic volcanic belts: Nedra, Moscow, 264 p. (in Russian).

Filippov, A.N., 1988, Mesozoic volcanogenic-sedimentary formations of the Bikinsk zone (Sikhote-Alin): Summary of Ph.D. thesis, U.S.S.R. Academy of Scieinces, Khabarovsk, 35 p. (in Russian).

Flerov, B.L., Trunilina, V.A., and Yakovlev, Ya.V., 1979, Tin-tungsten mineralization and magmatism of Eastern Yakutia: Nauka, Moscow, 276 p. (in Russian).

Follo, M.L., 1992, Conglomerates as clues to the sediementary and tectonic evolution of a suspect terrane, Wallowa Mountains, Oregon: Geological Society of America Bulletin, v. 104, p. 1561-1576.

Ford, A.B., and Brew, D.A., 1988, The Douglas Island Volcanics; basaltic-rift--not andesitic-arc--volcanism of the "Gravina-Nutzotin belt," northern southeastern Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 20, p. 111.

Foster, H.L., 1976, Geologic map of the Eagle quadrangle, Alaska: U.S. Geological Survey Miscellaneous Investigations Map Series I-922, scale 1:250,000.

Foster, H.L., Keith, T.E.C., and Menzie, W.D., 1994, Geology of east-central Alaska: U.S. Geological Survey Open-File Report 87-188, 59 p.

Foster, H.L., Keith, T.E.C., and Menzie, W.D., 1987, Geology of the Yukon-Tanana area of east-central Alaska, *in* Plafker, George, and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, v. G1, p. 205-240.

Friedman, R.M., and Armstrong, R.L., 1990, U-Pb dating, southern Coast Belt, British Columbia; in Project Lithoprobe: Southern Canadian Cordilleran Workshop volume, University of Calgary, p. 146-155.

Frizzell, V.A., Jr., Tabor, R.W. and Zartman, R.B., 1987, Late Mesozoic or early Tertiary melanges in the western Cascades of Washington: in in Schuster, E., ed., Selected Papers on the geology of Washington, Washington Division of Mines and Geology Bulletin, 77, p. 129-148.

Fujita, Kazuya, Cambray, F. W., and Velbel, M. A., 1990, Tectonics of the Laptev Sea and Moma rift systems, northeastern U.S.S.R.: Marine Geology, v. 93, p. 95-118.

Fujita, Kazuya, and Cook, D.B., 1990, The Arctic continental margin of eastern Siberia, *in* Grantz, A., Johnson, L., and Sweeney, J.F., eds., The Arctic Ocean Region: Geological Society of America, Geology of North America, v. L, p. 289-304.

Fujiwara, Y., Ohtake, T., 1975, Paleomagnetism of Late Cretaceous alkaline rocks in the Nemuro Peninsula: Journal of Geomagnetism and Electricity, v. 26, p. 549-558.

Fyles, J.T., and Eastwood, G.E.P., 1962, Geology of the Ferguson area, Lardeau district, Brtish Columbia, British Columbia Department of Mines and Petroleum Resources Bulletin 45, 75 p.

Gabrielse, H., 1985, Major dextral transcurrent displacements along the northern Rocky Mountain Trench and related lineaments in north-central British Columbia, Geological Society of America Bulletin, v. 96, p. 1-14.

Gabrielse, H., 1991, Late Paleozoic and Mesozoic terrane interactions in north-central British Columbia: Canadian Journal of Earth Sciences, v. 28, p. 947-957.

Gabrielse, H., and Yorath, C.J., eds., 1992, Geology of the Cordilleran Orogen in Canada: Geological Society of America, Geology of North America, v. G-2, 844 p.

Gabrielse, H., and Yorath, C.J., 1992, Tectonic synthesis, *in* Gabrielse, H., and Yorath, C.J., eds., Geology of the Cordilleran orogen in Canada:Geological Society of America, Geology of North America, v. G-2, p. 679-705.

Gagiev, M.K., and Lychagin, P.P., 1990, Volcanogenic-sedimentary Devonian type section of the Momsky Ridge sequence: Tikhookeanskaya Geologiya, no. 2., p. 53-58 (in Russian).

Gagiev, M.K., Shul'gina, V.S., and Kolesov, E.V., 1987, Stratigraphy and conodonts of the Upper Devonian and Lower Carboniferous in the Bereozovka River vicinity, Northeastern U.S.S.R.: Paleomagnetism in geology, U.S.S.R. Academy of Sciences, Magadan, p. 84-116 (in Russian).

Gaiduk, V.V., 1988, The middle Paleozoic Vilyui rift system: Yakutian Scientific Center, U.S.S.R. Academy of Sciences, 127 p. (in Russian).

Gaiduk, V.V., Grinenko, O.V., Imaev B.S., Safronov, A.F., and Sergeenko, A.I., 1988, Oil and gas potential of the Indigirka-Zyryanka basin: Geologic and Economic Aspects of Oil and Gas Development in Yakutia, Yakutian Scientific Center, U.S.S.R. Academy of Sciences , p. 35-90 (in Russian).

Gaiduk, V.V., Grinenko, O.V., and Syundyukov, I. Sh., 1993, Age of folding in the Moma Zyryanka basin. Tikhookeanskaya Geologiya, no. 3, p. 99-108 (in Russian).

Gaiduk, V.V., Syundukov, I.Sh., Grinenko, O.V., and Imaev, V.S., 1989, Structure and oil and gas potential of the Cenozoic Indigirka-Zyryanka Basin: Tectonics and Oil and Gas Prospecting in Yakutia, Yakutian Scientific Center, U.S.S.R. Academy of Sciences, p. 75-87 (in Russian).

Gardner, M.C., Bergman, S.C., Cushing, G.W., Mackevett, E.M. Jr., Plafker, G., Campbell, R.B., Dodds, C.J., McClelland, W.C., and Mueller, P.A., 1988, Pennsylvanian pluton stiching of Wrangellia and the Alexander Terrane, Wrangell Mountains, Alaska, Geology, v. 16, p. 967-971.

Garver, J.I., 1992, Provenance of Albian-Cenomanian rocks of the Methow and Tyaughton basins, southern British Columbia: a mid-Cretaceous link between North America and Insular terranes: Canadian Journal of Earth Sciences, v. 96, p.1-14.

Gavrilov, V.K., and Solov'eva, N.A., 1973, Volcano-sedimentary formations of geoanticlinal uplifts of Minor and Great Kurils: Nauka, Novosibirsk, 130 p. (in Russian).

Ged'ko, M.I., 1988, Late Jurassic Uyandina-Yasachnaya island arc: Geotektonika, no. 2, p. 88-100 (in Russian).

Gehrels, G.E., 1990, Late Proterozoic-Cambrian metamorphic basement of the Alexander terrane on Long and Dall Islands, southeast Alaska: Geological Society of America Bulletin, v. 102, p. 760-767.

Gehrels, G.E., 1991, Geologic map of Long Island and southern and central Dall Island, southeastern Alaska: U.S. Geological Survey Map MF-2146, 1 sheet, scale 1:63,360.

Gehrels, G.E., and Berg, H.C., 1992, Geologic map of southeastern Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-1867, 1 sheet, scale 1:600,000, 24 p.

Gehrels, G.E., and Berg, H.C., 1994, Geology of southeastern Alaska, *in* Plafker, George, and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, v. G1, p. 451-468.

Gehrels, G.E., and McClelland, W.C., 1992, Geology of the western flank of the Coast Mountains between Cape Fanshaw and Taku Inlet, southeastern Alaska: Tectonics, v. 11, p. 567-585.

Gehrels, G.E., McClelland, W.C., Sampson, S.D., Patchett, P.J., and Jackson, J.L., 1990, Ancient continental margin assemblage in the northern Coast Mountains, southeast alaska and northwest Canada: Geology, v. 18, p.208-211.

Gehrels, G.E., McClelland, W.C., Samrson, S.D., and Patchett, P.J., 1992, Geology of the western flank of the Coast Mountains between Cape Fanshaw and Taku Inlet, southeastern Alaska, Tectonics, v. 11, p. 567-585.

Gehrels, G.E., McClelland, W.C., Samson, S.D., Patchett, P.J., and Jackson, J.L., 1990, Ancient continental margin assemblage in the northern Coast Mountains, southeastern Alaska and northwestern Canada: Geology, v. 18, p. 208-211.

Gehrels, G.E., and Saleeby, J.B., 1986, Geologic map of southern Prince of Wales Island, southeastern Alaska: U.S. Geological Survey Open-File Report 86-275, 33 p.

Gehrels, G.E., and Saleeby, J.B.,1987, Geology of southern Prince of Wales Island, southeastern Alaska: Geological Society of America Bulletin, v. 98, p. 123-137.

Gehrels, G.E., Saleeby, J.B., and Berg, H,C., 1987, Geology of Annette, Gravina, and Duke Islands, southeastern Alaska: Canadian Journal of Earth Sciences, v. 24, p. 866-881.

Geist, E.L., Scholl, D.W., and Vallier, T.L., 1991, Collison of the Aleutian Island arc with Kamchatka: Eos, v. 72, p. 440.

Geist, E.L., Vallier, T.L., and Scholl, D.W., 1994, Origin, transport, and emplacement of an exotic island-arc terrane exposed in eastern Kamchatka, Russia: Geological Society of America Bulletin, v. 106, p. 1182-1194.

Gel'man, M.L., Bychkov, Yu.M., and Levin, B.S., 1988, Boninite in the Koryak Highland: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 2, p. 35-47 (in Russian).

Geodekyan, A.A., Udintsev, G.B., Baranov, B.V., Bersenev, A.F., Berk, K., Bogatikov, O.A., Gabov, V.V., Gnibidenko, G.S., Dmitriyev, Yu. I., Zonenshain, L.P., Kurentsova, N.A., Rasnitsin, Yu. N., Rudnik, G.B., and Sushchevskaya N.M., 1976, Bedrock of the seafloor, central part of the Sea of Okhotsk: Sovetskaya Geologiya, no. 6, p.12-31. (in Russian).

Geology of the U.S.S.R., 1970, Sakhalin Island: Nedra, Moscow, v. 33, 430 p. (in Russian).

Gergen, L.D., Decker, J.E., and Plafker, George, 1988, A comparative study of sandstone from the Wilber Creek, Cascaden Ridge, and Wickersham units in the Livengood quadrangle, *in* Galloway, J.P., and Hamilton, T.D., eds., Geologic Studies in Alaska by the United States Geological Survey during 1987: U.S. Geological Survey Circular 1016, p. 57-60.

German, L.L., 1978, Ancient crystalline complexes of Kamchatka: Nedra, Moscow, 128 p. (in Russian).

German, L.L., Shul'diner, V.I., and Shcheka, S.A., 1976, Metamorphic complexes of the Ganal' Range in Kamchatka: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 39, p. 25-35 (in Russian).

Gilbert, W.G., and Bundtzen, T.K., 1984, Stratigraphic relationships between Dillinger and Mystic terranes, western Alaska Range, Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 16, p. 286.

Gilbert, W.G., Nye, C.J., and Sherwood, K.W., 1984, Stratigraphy, petrology, and geochemistry of Upper Triassic rocks from the Pingston and McKinley terranes, central Alaska Range: Alaska Division of Geological and Geophysical Surveys Report of Investigation 84-30, 14 p.

Glassley, W. E., 1974, Geochemistry and tectonics of the Crescent volcanic rocks, Olympic Peninsula, Washington: Geological Society of America Bulletin, v. 85, p. 785-794.

Gnibidenko, G.S., 1976, Rift system of the floor of the Sea of Okhotsk: Doklady Akademii Nauk SSSR, v. 229, no 1, p. 163-165 (in Russian).

Gnibidenko G.S., Bykova T.G., Veselov O.V., Vorob'ev V.M., Kim, Chun Un, and Tarakanov, R.Z., 1980, Tectonics of the Kuril-Kamchatka trench: Nauka, Moscow, 179 p. (in Russian).

Gnibidenko, G.S., and Khvedchuk, I.I., 1982, Tectonics of the Okhotsk Sea: Marine Geology, v. 50, p. 155-198.

Gnibidenko, G.S., and Svarichevsky, A.S., 1984, Tectonics of the South Okhotsk deep-sea basin: Tectonophysics, v. 102, p. 225-244.

Golionko, B.G., 1992, Structural and geological development of the southern Kuril Island arc from the Late Cretaceous to Miocene in connection with the subduction of the Pacific plate: Summary of Candidate of Science thesis, Moscow, 23 p. (in Russian).

Golozubov, V.V., and Melnikov, N.G., 1986, Tectonics of geosynclinal complexes of the south Sikhote-Alin: U.S.S.R. Academy of Sciences, Vladivostok, 128 p. (in Russian).

Golozubov, V.V., Khanchuk, A.I., Kemkin, I.V., Panchenko, I.V., and Simanenko, V.P., 1992, Taukha and Zuravlevka terranes of South Sikhote-Alin: U.S.S.R. Academy of Sciences, Vladivostok, 83 p. (in Russian).

Gordey, S.P., 1992, Geological fieldwork in Teslin map area, southern Yukon Territory, *in* Current Research, Part A: Geological Survey of Canada Paper 92-1A, p. 279-286.

Gorodinskiy, M.E., 1963, Geology of Central areas of Chukotka: Materials on geology and mineral deposits of the U.S.S.R. Northeast, v. 16, U.S.S.R. Academy of Sciences, Magadan, p. 34-37 (in Russian).

Gorodinskiy, M.E., and Paraketsov, K.V., 1960, Stratigraphy and tectonics of Mesozoic deposits in the Raucha Basin: Materials on geology and mineral deposits of U.S.S.R. Northeast, U.S.S.R. Academy of Sciences, Magadan, v. 14, p. 13-26 (in Russian).

Goroshko, M.V., 1983, Structural restrictions and history of development and tectonic zonation of the middle Khanka Massif: Tikhookeanskaya Geologiya, no. 1, p. 20-29 (in Russian).

Gottschalk, R.R., Jr., 1990, Structural evolution of the schist belt, south-central Brooks Range fold and thrust belt, Alaska: Journal of Structural Geology, v. 12, p. 453-469.

Grannik V.M., 1978, Upper Cretaceous volcano-sedimentary formations of the East-Sakhalin mountains: Nauka, Moscow, 164 p. (in Russian).

Grantz, Arthur, Elttreim Steven, Whitney, O.T., 1981, Geology and physiography of the continental margin north of Alaska and implications for the origin of the Canada basin, *in* Nairn, A.E.M., Churkin, Michael, Jr., and Stehli, F.G., eds., The Ocean Basins and Margins, v. 5, Geology of the Arctic Ocean Basin and its margins: Plenum Press, New York and London, p. 439-492.

Grantz, Arthur, Holmes, M. L., and Kososki, B. A., 1975, Geologic framework of the Alaskan continental terrace in the Chukchi and Beautfort Seas: Canadian Society of Petroleum Geologists Memoir, v. 4, p. 669-700.

Grantz, Arthur, and May, S.D., 1983, Rifting history and structural development of the continental margin north of Alaska, *in* Watkins, J.S., and Drake, C., eds., Continental margin processes: American Association of Petroleum Geologists Memoir 34, p. 77-100.

Grantz, Arthur, May, S.D., Taylor, P.T., and Lawver, L.A., 1990, Canada Basin, *in* Grantz, Arthur, Johnson, G.L., and Sweeney, J.F., eds., The Arctic Ocean Region: Geological Society of America, Geology of North America, v. L, p. 379-402.

Grantz, Arthur, Moore, T.E., and Roeske, S.M., 1991, Gulf of Alaska to Arctic Ocean: Geological Society of America Continental/Ocean Transect A-3, 72 p., 3 sheets, scale 1:500,000.

Grantz, Arthur, Mullen, M.W., Phillips, R.L., and Hart, P.E., 1992, Significance of extension, convergence, and transform faulting in the Chukchi continental borderland for the Cenozoic tectonic development of the Arctic Basin [abs.]: Geological Association of Canada Abstracts, v. 17, p. A42.

Grantz, Arthur, Tailleur, I.L., and Carter, Claire, 1983, Tectonic significance of Silurian and Ordovician graptolites from the Lisburne Peninsula, northwest Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 15, p. 274.

Grapes, R., 1986, Mesozoic arc-trench development and Cenozoic orogeny of the North-West Pacific rim with special reference to Hokkaido: Association for Geological Collaboration in Japan Monograph 31, p. 419-439.

Green, N.L., 1981, Geology and petrology of Quaternary volcanic rocks, Garibaldi Lake area, southwestern Brtisih Columbia: Summary: Geological Society of America Bulletin, v. 92, p. 697-702.

Grigor'yev, V.N., Krylov, K.A., and Sokolov, S.D., 1987a, Main formational types of Mesozoic deposits in the Koryak Highland and their tectonic implication, *in* Early geosynclinal formations and structures: Nauka, Moscow, P. 198-245 (in Russian).

Grigor'yev, V.N., Krylov, K.A., and Sokolov, S.D., 1987b, Jurassic-Cretaceous deposits of the Yanranaysk accretionary complex, *in* Essays on geology of northwestern sector of the Pacific tectonic belt: Nauka, Moscow, p. 110-140 (in Russian).

Grinberg, G.A., Gusev, G.S., Bakharev, A.G., 1981, Tectonics, magmatic, and metamorphic complexes of the Kolyma-Omolon Massif: Nauka, Moscow, 400 p. (in Russian).

Grinenko, O.V., Zharikova, L.P., Fradkina, A.F., and others, 1989, Paleogene and Neogene of the U.S.S.R. Northeast: U.S.S.R. Academy of Sciences, Yakutsk, 184 p. (in Russian).

Gusev, G.S., Petrov, A.F., Fradkin, G.S., and others, 1985, Structure and evolution of the earth's crust of Yakutia: Nauka, Moscow, 248 p. (in Russian).

Hackett, D.J., Layer, P.W., Fujita, Kazuya, and Parfenov, L.M., 1992, Geochronology of granites in the Cherski Range, Yakutia, and implications for accretion of terranes to the Siberian craton [abs.]: Eos, v. 73, p. 652.

Haeussler, P.J., 1992, Structural evolution of an arc-basin: The Gravina belt in central southeastern Alaska: Tectonics, v. 11, p. 1245-1265.

Haeussler, P., Coe, R.S., Onstott, T.C., 1992a, Paleomagnetism of the Late Trassic Hound Island volcanics revisited: Journal of Geophysical Research, v. 97, p. 19,617-19,640.

Haeussler, P.J., Coe, R.S., Renne, P., 1992b, Paleomagnetism and geochronology of 23 Ma gabbroic intrusions in the Keku Strait, Alaska, and implications for the Alexander terrane: Journal of Geophysical Research, v. 97, p. 19,641-19,651.

Halgedahl, S.L., Jarrard, R.D., 1987, Paleomagnetism of the Kuparuk River Formation from oriented drill core: Evidence for rotation of the Arctic Alaska Plate, in Tailleur, I., Weimer, P. eds., Alaskan North Slope Geology: Society of Economic Paleontologists and Mineralogists, v. 2, p. 581-617.

Hall, John K., 1970, Arctic Ocean geophysical studies: The Alpha Cordillera and Mendeleyev Ridge [abs.]: Ann Arbor, Mich., University Microfilms International, 116 p.

Hansen, V.L., 1991, Mesozoic thermal evolution of the Yukon-Tanana composite terrane: new evidence from $^{40}Ar/^{39}Ar$ data: Tectonics, v. 10, p. 51-76.

Harbert, W., 1987, New Paleomagnetic data from the Aleutian Islands: Implication for terrane migration and deposition of the Zodiac Fan. Tectonics, v. 6., p. 585-602.

Harms, T.A., Nelson, J., and Bradford, J., 1988, Geological transect across the Sylvester allochthon, north of the Blue River, northern British Columbia, *in* British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1987, Paper 1988-1, p. 245-248.

Harris, R.A., 1985, Paleomagnetism, geochronology and paleotemperature of the Yukon-Koyukuk province, Alaska. M.S. Thesis, University of Alaska, 145 p.

Harris, R.A., Stone, D.B. and Turner, D.L., 1986, Tectonic implications of paleomagnetic and geochronologic data from the Yukon-Koyukuk province, Alaska: Geological Society of America Bulletin, v. 99, 362-375.

Hasegawa, K., and Suzuki, M., 1964, Geology of the Goryokaku district Japan: Geological Survey of Japan, 23 p., scale, 1:50,000 (in Japanese with English abstract).

Hata, M., and Kakimi, T., 1979, Geology of the Kikonai district, Japan: Geological Survey of Japan, 56 p., scale 1:50,000 (in Japanese with English abstract).

Haugerud, R.A., van der Heyden, P., Tabor, R.W., Stacey, J.S., and Zartman, R.E., 1991, Late Cretaceous and early Tertiary plutonism and deformation in the Skagit Gneiss Complex, North Cascades Range, Washington and British Columbia: Geological Society of America Bulletin, v. 103, p. 1297-1307.

Heiphitz, A., Harbert, W., and Savostin, L.A., 1994a, Reconnaissance paleomagnetism of the Olyutorsky superterrane, northeast Russia, *in* Thurston, D., and Fujita, K., eds., Proceedings of 1994 International Conference on Arctic Margins: U.S.Department. of Interior, Minerals Management Service, Anchorage, p. 223-228.

Heiphitz, A., Harbert, W., Layer, P., 1994b, Preliminary reconnaissance paleomagnetism of some late Mesozoic ophiolites, Kuyul region, Koryak superterrane, Russia, *in* Thurston, D., and Fujita, K., eds., Proceedings of 1994 International Conference on Arctic Margins: U.S. Department. of Interior, Minerals Management Service, Anchorage, p. 229-234.

Heller, P.L., Peterman, Z.E., O'Neil, J.R., and Shafiqullah, M., 1985, Isotopic provenance of sandstone of the Eocene Tyee Formation, Oregon Coast Range: Geological Society of America Bulletin, v. 96, p. 770-780

Heller, P.L., Tabor, R.W., O'Neil, J.R., Pevear, D.R., Shafiqullah, M., and Winslow, N, Isotopic provenance of Paleogene sandstones from the accretionary core of the Olympic Mountains, Washington: Geological Society of America Bulletin, in press.

Heller, P.L., Tabor, R.W., and Suczek, C.A., 1987, Paleogeographic evolution of the United States Pacific Northwest during Paleogene time: Canadian Journal of Earth Sciences, v. 24, p. 1652-1667.

Hicken, A., Irving, E., 1977, Tectonic rotation in western Canada: Nature, v. 268, p. 219-220.

Higgs, R., 1991, Sedimentology, basin-fill architecture and petroleum geology of the Tertiary Queen Charlotte Basin, British Columbia, *in* Evolution and hydrocarbon potential of the Queen Charlotte Basin, British Columbia: Geological Survey of Canada Paper 90-10, p. 337-371.

Hillhouse, J.W., 1977, Paleomagnetism of the Triassic Nikolai Greenstone, McCarthy Quadrangle, Alaska: Canadian Journal of Earth Sciences, v. 14, p. 2,578-2,592.

Hillhouse J.W. and Gromme, C.S., 1982, Limits to northward drift of the Paleocene Cantwell formation, central Alaska: Geology, v. 10, p. 552-566.

Hillhouse, J.W. and Gromme, C.S., 1984, Northward displacement and accretions of Wrangellia: New paleomagnetic evidence from Alaska: Journal of Geophysical Research, v. 89, p. 4,461-4,477.

Hillhouse, J.W. and Gromme, C.S., 1988, Early Cretaceous Paleolatitude of the Yukon-Koyukuk province: Journal of Geophysical Research, v. 93, 11,735-11,752.

Hillhouse, J.W., Gromme, C.S. and Csejtey, B., 1985, Tectonic implications of paleomagnetic poles from Lower Tertiary volcanic rocks, South central Alaska: Journal of Geophysical Research, v. 90, p. 12,523-12,535.

Hillhouse, J.W., Gromme, C.S., and Vallier, T.L., 1982, Paleomagnetism and Mesozoic tectonics of the Seven Devils volcanic arc in northeastern Oregon: Journal of Geophysical Research, v. 87, p. 3777-3794.

Hitzman, M.W., Smith, T.E., and Proffett, J.M., 1982, Bedrock geology of the Ambler district, southwestern Brooks Range, Alaska: Alaska Division of Geologic and Geophysical Surveys Geologic Report 75, 2 pls., scale 1:63,360.

Hoare, J.M., Conden, W.H., Cox, A. and Dalrymple, G.B., 1968, Geology, Paleomagnetism and K-Ar ages of basalts from Nunivak Ilsand, Alaska: Geological Society of America Memoir, v. 116, p. 337-413.

Hoare, J.M., and Coonrad, W.L., 1978, Geologic map of the Goodnews and Hagemeister Island quadrangles region, southwestern Alaska: U. S. Geological Survey Open-File Report 78-9-B, scale 1:250,000.

Hoare, J.M., and Coonrad, W.L., 1979, The Kanektok metamorphic complex, a rootless belt of Precambrian rocks in southwestern Alaska, *in* Johnson, K.M., and Williams, J.R., eds., The United States Geological Survey in Alaska: Accomplishments during 1978: U.S. Geological Survey Circular 804-B, p. B72-B74.

Hoare, J.M., and Jones, D.L., 1981, Lower Paleozoic radiolarian chert and associated rocks in the Tikchik Lakes-area, southwestern Alaska, *in* Albert, N.R.D., and Hudson, Travis, eds., The United States Geological Survey in Alaska: Accomplishments during 1979: U.S. Geological Survey Circular 823-B, p. 44-45.

Hoffman, P.F., 1989, Precambrian geology and tectonic history of North America, *in* Bally, A.W., and Palmer, A.R., eds., The Geology of North America - An overview, Boulder, Colorado, Geological Society of America: The geology of North America, v. A., p. 447-512.

Hooper, P.R., 1982, The Columbia River Basalts: Science, v. 215, p. 1463-1468.

Hooper, P.R., and Conrey, R.M., 1989, A model for the tectonic setting of the Columbia River basalt eruptions, *in* Reidel, S.P. and Hooper, P.R., eds., Volcanism and tectonism in the Columbia River flood-basalt province: Geological Society of America Special Paper 239, p. 293-306.

Howell, D.G., Johnsson, M.J., Underwood, M.B., Lu, Huafu, and Hillhouse, J.W., 1992, Tectonic evolution of the Kandik region, east-central Alaska: Preliminary interpretations, *in* Bradley, D.C., and Ford, A.B., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1990: U.S. Geological Survey Bulletin 1999, p. 127-140.

Howell, D.G., Jones, D.L., and Schermer, E.R., 1985, Tectonostratigraphic terranes of the Circum-Pacific region: Principles of terrane analysis, *in* Howell, D.G., ed., Tectonostratigraphic terranes of the Circum-Pacific region: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, v. 1, p. 3-31.

Howell, D.G., and Wiley, T.J., 1987, Crustal evolution of northern Alaska inferred from sedimentology and structural relations of the Kandik area: Tectonics, v. 6, p. 619-631.

Hudson, T., 1983, Calc-alkaline plutonism along the Pacific rim of southern Alaska, *in* Roddick, J.A., ed., Circum-Pacific plutonic terranes, Geological Society of America Memoir 159, p. 195-211.

Hudson, Travis, 1977, Geologic map of Seward Peninsula, Alaska: U.S. Geological Survey Open-File Report 77-796-A, scale 1:1,000,000.

Hudson, Travis, and Plafker, George, 1982, Paleogene metamorphism of an accretionary flysch terrane, eastern Gulf of Alaska: Geological Society of America Bulletin, v. 93, p. 1280-1290.

Hunkins, Kenneth, Herron, Thomas, Kutschale, Henry, and Peter, George, 1962, Geophysical studies of the Chukchi Cap, Arctic Ocean: Journal of Geophysical Research, v. 67, p. 235-247.

Hunkins, Kenneth and Tiemann, Werner, 1977, Geophysical data summary for Fletcher's Ice Island (T-3; May 1962 - October 1974): Lamont-Doherty Geological Observatory, Survey of the World Ocean, Technical Report No. CU-1-77, 219 p.

Imlay, R.W., and Detterman, R.L., 1973, Jurassic paleobiogeography of Alaska: U.S. Geological Survey Professional Paper 801, 34 p.

Ingle J.C., Karig D.E., and Bouma A.N., 1975, Leg 31: Deep-Sea Drilling Project Initial Reports, v. 31, p. 351-439.

Iosifidi, A.G., 1989, Paleomagnetic directions and pole positions: Data for the USSR - Soviet Geophysical Committee: World Data Center-B, Moscow, Catalog, Issue 7, as quoted in the Lock and McElhinny (1991) database.

Irving, E., and Archibald, D.A., 1990, Bathozonal tilt corrections to paleomagnetic data from mid-Cretaceous plutonic rocks: Examples from the Omineca Belt, British Columbia: Journal of Geophysical Research, v. 95, p. 4579-4586.

Irving, E., and Brandon, M.T., 1990, Paleomagnetism of the Flores volcanics, Vancouver Island, in place by Eocene time: Canadian Journal of Earth Sciences, v. 27, p. 811-817.

Irving E., and Monger, J.W.H., 1987, Preliminary paleomagnetic results from the Permian Asitka Group, British Columbia: Canadian Journal of Earth Sciences, v. 24, p. 1,490-1,497.

Irving, E., and Thorkelson, D.J., 1990, On determining paleohorizontal and latitudinal shifts: Paleomagnetism of Spences Bridge Group, British Columbia: Journal of Geophysical Research, v. 95, p. 19,213-19,234.

Irving, E., and Wynne, P.J., 1990, Paleomagnetic evidence bearing on the evolution of the Canadian Cordillera: Transactions of Royal Philosophical Society of London, v. A331, p. 487-509.

Irving, E., and Yole., R.W., 1987, Tectonic rotations and translations in western Canada: new evidence from Jurassic rocks of Vancouver Island: Geophysical Journal of the Royal Astronomical Society, v. 91, p. 1,025-1,048.

Ishiga, H., and Ishiyama, D., 1987, Jurassic accretionary complex in Kaminokuni terrane, southwestern Hokkaido, Japan: Mining Geology, v. 37, p. 381-394.

Ishida, M., Kakimi, T., Hirayama, J., and Hata, M., 1975, Geology of the Tate district, Japan: Geological Survey of Japan, 52 p., scale 1:50,000.

Ishizuka, H., 1980, Geology of the Horokanai ophiolite in the Kamuikotan tectonic belt: Geological Society of Japan Journal, v. 86, p. 119-134.

Ivanov, V.V., Klubev, B.A., Lozhkina, N.V.,and Pokhialainen, V.P., 1977, Stratigraphy and paleomagnetic characteristics of the upper Jurassic and lower Cretaceous deposits of Stolbovoi island (Novosibirskiy Archipelago): Geologiya i Geofizika, v. 18, p. 84-89.

Ivanov, L.N., Pertsev, A.I., and Il'chenko, L.N., 1989, Precambrian metamorphic rocks of the Anadyr'-Koryak region: U.S.S.R. Academy of Sciences, Magadan, 62 p (in Russian).

Ivanov, V.V., and Pokhialainen, V.P., 1973, Cretaceous deposits of the southern Penzhina basin in relation to oil and gas potential, *in* Problems of oil and gas potential of Northeastern U.S.S.R.: U.S.S.R. Academy of Sciences, Magadan, p. 70-107 (in Russian).

Ivashchenko, R.U. Kazakova, E.N., Sergeev, K.F., Sergeeva, V.B., and Strel'tsov, M.I., 1984, Geology of the Komandorskiye Islands: U.S.S.R. Academy of Sciences, Vladivostok, 192 p. (in Russian).

Iwata, K., and Tajika, J., 1986, Late Cretaceous radiolarians of the Yubetsu Group, Tokoro belt, northeast Hokkaido, Japan: Journal of the Faculty of Science, Hokkaido University: ser. 4, v. 21, p. 619-644.

Iwata, K., and Tajika, J., 1989, Jurassic and Cretaceous radiolarians from the pre-Tertiary system in the Hidaka Belt, Maruseppu region, northeast Hokkaido, Japan: Journal of the Faculty of Science, Hokkaido University, ser. 4, v. 22, p. 453-466.

Izosov, A.A., Kandaurov, A.T., Bazhanov, V.A., Koren, T.N., Shishkina, G.P., Kolobova, I.M., and Kul'kov, N.P., 1988, Silurian deposits of Primorie: Tikhookeanskaya Geologiya., no. 5, p. 75-82 (in Russian).

Jackson, H.R., 1985, Seismic reflection results from CESAR, *in* Jackson, H.R., Mudie, P.J. and Blasco, S.M., eds., Initial Geological Report on CESAR--the Canadian Expedition to Study the Alpha Ridge, Arctic Ocean: Geological Survey of Canada Paper 84-22, p. 19-23.

Jackson, J.L., Gehrels, G.E., Patchett, P.J., and Mihalnyuk, M.G., 1990, Late Triassic depositional link between the northern Stikine terrane and Nisling asssemblage, northwestern Canada [abs.]: Geological Society of America, Abstracts with Programs, v. 22, p. A325.

Johnson, B.R., and Karl, S.M., 1985, Geologic map of western Chichagof and Yakobi Islands, southeastern Alaska: U.S. Geological Survey Map I-1506, 1 sheet, 15 p. pamphlet.

Johnson, S.Y., 1984, Stratigraphy, age, and paleogeography of the Eocene Chuckanut Formation, northwest Washington: Canadian Journal of Earth Sciences, v. 21, p. 92-106.

Johnson, S.Y., 1985, Eocene strike-slip faulting and nonmarine basin formation in Washington, *in* Biddle, K.T. and Christie-Blick, N., eds., Strike-slip deformation, basin formation and sedimentation: Society of Economic Paleontologists and Mineralogists Special Publication, v. 37, p. 283-302.

Jones, D.L., Coney, P.J., Harms, T.A., and Dillon, J.T., 1988, Interpretive geologic map and supporting radiolarian data from the Angayucham terrane, Coldfoot area, southern Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1993, 1 sheet, scale 1:63,360.

Jones, D.L., Howell, D.G., Coney, P.J., and Monger, J.W.H., 1983, Recognition, character, and analysis of tectonostratigraphic terranes in western North America, *in* Hashimoto, M., and Uyeda, S., eds., Accretion tectonics in the circum-Pacific region: Proceedings of the Oji International Seminar on Accretion Tectonics, Japan, 1981: Advances in Earth and Planetary Sciences, Tokyo, Terra Scientific Publishing Co., p. 21-35.

Jones, D.L., Silberling, N.J., Berg, H.C., and Plafker, George, 1981, Map showing tectonostratigraphic terranes of Alaska, columnar sections, and summary description of terranes: U.S. Geological Survey Open-File Report 81-792, 20 p., 2 sheets, scale 1:2,500,000.

Jones, D.L., Silberling, N.J., Coney, P.J., and Plafker, George, 1984, Lithotectonic terrane map of Alaska, *in* Silberling, N.J., and Jones, D.L., eds., Lithotectonic terrane maps of the North American Cordillera: U.S. Geological Survey Open-File Report 84-523, p. A1-A12, 1 sheet, scale 1:2,500,000.

Jones, D.L., Silberling, N.J., Coney, P.J., and Plafker, George, 1986, Collision tectonics in the Cordillera of western North America: Examples from Alaska, *in* Coward, M.P., and Ries, A.C., eds., Collision Tectonics: Geological Society Special Publication 19, p. 367-387.

Jones, D.L., Silberling, N.J., Coney, P.J., and Plafker, George, 1987, Lithotectonic terrane map of Alaska (West of the 141st Meridan): U.S. Geological Survey Map MF-1874-A, 1 sheet, scale 1:2,500,000.

Jones, D.L., Silberling, N.J., Csejtey, Béla, Jr., Nelson, W.H., and Blome, C.D., 1980, Age and structural significance of ophiolite and adjoining rocks in the upper Chulitna district, south-central Alaska: U.S. Geological Survey Professional Paper 1121-A, 21 p.

Jones, D.L., Silberling, N.J., Gilbert, Wyatt, and Coney, Peter, 1982, Character, distribution, and tectonic significance of accretionary terranes in the central Alaska Range: Journal of Geophysical Research, v. 87, no. B5, p. 3709-3717.

Jones, D.L., Silberling, N.J., and Hillhouse, J.W., 1977, Wrangellia--a displaced terrane in northwestern North America: Canadian Journal of Earth Sciences, v. 14, p. 2565-2577.

Journeay, J.M., and Friedman, R.M., 1993, The Coast Belt thrust system: evidence of Late Cretaceous shortening in southwest British Columbia, Tectonics, v. 12, p. 756-775.

Journeay, J.M., 1990, A progress report on the structural and tectonic framework of the southern Coast Belt, British Columbia, *in* Current Research, Part E: Geological Survey of Canada Paper 91-1E, p. 183-195.

Journeay, J.M., and Northcote B.R., 1992, tectonic aseemblages of the eastern Coast Belt, southwest British Columbia, *in* Current research, Part A: Geological Survey of Canada Paper 92-1A, p. 215-224.

Kaidalov, V.A., 1990, Stratigraphy of Cretaceous deposits in Lower Primorye, *in* Precambrian and Phanerozoic stratigraphy of the Transbaikal region and the southern Far East: Abstracts of the 14th Far East Regional Interdepartment Stratigraphic Meeting, Khabarovsk, p. 236-239 (in Russian).

Kameneva, G.I., 1975, Structure of the central part of Wrangel Island, *in* Geology and Mineral Deposits of New Siberian Islands and Wrangel Island: NIIGA. Ministry of Geology, Leningrad, p. 72-77 (in Russian).

Kameneva G.I. 1977, Problems of Wrangel Island and the structural relationship with Alaska, *in* Tectonics of folded basement of shelf sedimentary basins of the Arctic: NIIGA, Ministry of Geology, Leningrad, p. 122-131 (in Russian).

Karasik A.M., 1980, Principal characteristics of history and structure of the structure of the Arctic Ocean from airborne magnetometric data, *in* Marine geology, sedimentology, sedimentary geology, and petrology of the oceans, Nedra, Leningrad, p. 178-193 (in Russian)

Kano, K., Kato, H., Yanagisawa, Y., and Yoshida, F., 1991, Stratigraphy and geologic history of the Cenozoic of Japan: Geological Survey of Japan Report 274, 114 p. (in Japanese with English abstract).

Karasik, A.M., 1968, Magnetic anomalies of the Gakkel Ridge, and the origin of the Eurasia subbasin of the Arctic Ocean: Geofizicheskie Metody Razvedki v Arktiki, no. 5, p. 8-19 (in Russian).

Karl, S.M., 1992, Age and extensional basin geochemical and tectonic affinities for the Maiyumerak basalts in the western Brooks Range, *in* Bradley, D.C., and Ford, A.B., eds., Geologic Studies by the U.S. Geological Survey, 1990: U.S. Geological Survey Bulletin 1999, p. 141-155.

Karl, S.M., and Aleinikoff, J.N., 1990, Proterozoic U-Pb zircon age of granite in the Kallarichuk Hills, western Brooks Range, Alaska: Evidence for Precambrian basement in the schist belt, *in* Dover, J.H., and Galloway, J.P., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1989: U.S. Geological Survey Bulletin 1946, p. 95-100.

Karl, S.M., Brew, D.A., and Wardlaw, B.R., 1990, Significance of Triassic marble at Nakwasina Sound, southeastern Alaska, *in* Dover, J.H., and Galloway, J.P., eds., Geologic studies in Alaska by the U.S. Geological Survey in 1989: U.S. Geological Survey Bulletin 1946, p. 21-28.

Karl, S.M., Dumoulin, J.A., Ellersieck, Inyo, Harris, A.G., and Schmidt, J.M., 1989, Preliminary geologic map of the Baird Mountains quadrangle, Alaska: U.S. Geological Survey Open-File Report 89-551, 65 p., 1 sheet, scale 1:250,000.

Karl, S., and Hoare, J.M., 1979, Results of a preliminary paleomagnetic study of volcanic rocks from Nuyakuk Lake, southwestern Alaska: U.S. Geological Survey Circular 804B, p. B74-B78.

Karsakov, L.P., Makhinin, A.V., Mikhalevsky, A.N., and Ostapchuk, V.I., 1987, The Baladeksky Point, its magmatic complexes and structural position (west Priokhotie): Tikhookeanskaya Geologiya, no. 1, p. 92-110 (in Russian).

Kato, M., Katsui, Y., Kitagawa, Y., and Matsui, M., eds., 1990, Regional geology of Japan, part 1, Hokkaido: Kyoritsu Shuppan, 333 p. (in Japanese with English abstract).

Kato, T., and Nakagawa, M. ,1986, Tectogenesis of ultramafic rocks in the Kamuikotan tectonic belt, Hokkaido, Japan: Association for Geological Collaboration in Japan Monograph 31, p. 119-135 (in Japanese with English abstract).

Kawamura M., Tajika, J., Kawamura, T., and Kato, Y., 1986, Constitution and occurrences of the Paleozoic and Mesozoic formations in southwest Hokkaido, northern Japan: Association for Geological Collaboration in Japan Monograph 31, p. 17-32. (in Japanese with English abstract).

Kazimirov, A.D., 1985, Nappes of the eastern Koryak Highland and their structural and formational homologues: Nauka, Moscow, 112 p. (in Russian).

Keith, T.E., Foster, H.L., Foster, R.L., Post, E.V., and Lehmbeck, W.L., 1981, Geology of an alpine-type peridotite in the Mount Sorenson area, east-central Alaska: U.S. Geological Survey Professional Paper 1170-A, 9 p.

Khanchuk, A.I., 1993, Geologic setting and evolution of the northwest Pacific continental framework: Summary of Ph.D. dissertation, Geological Institute, Russian Academy of Sciences, Moscow, 31 p. (in Russian).

Khanchuk, A.I., Golozubov, V.V., Panchenko, I.V., Ignatiev, A.V., Chudaev, O.V., 1992, Ganychalan terrane of Koryak Upland: Tikhookeanskaya Geologiya, no. 4, p. 82-94 (in Russian).

Khanchuk, A.I., Grigor'yev, V.N., Golozubov, V.V., Govorov, G.I., Krylov, K.A., Kurnosov, V.B., Panchenko, I.V., Pral'nikova, I.E., and Chudaev, O.V., 1990, Kuyul ophiolitic terrane: U.S.S.R. Academy of Sciences, Vladivostok, 108 p. (in Russian).

Khanchuk A.I., Panchenko I.V., and Kemkin I.V., 1988, Paleozoic and Mesozoic geodynamic evolution of the Sikhote-Alin area and Sakhalin Island: U.S.S.R. Academy of Sciences, Vladivostok, 56 p. (in Russian).

Khramov, A.N., 1971, Paleomagnetic directions and pole positions: Data for the USSR - Issue 1, Soviet Geophysical Committee: World Data Center-B (Moscow), Catalog, as quoted in the Lock and McElhinny (1991) database.

Khramov, A.N., 1979, Paleomagnetic directions and pole positions: Data for the USSR - Issue 4, Soviet Geophysical Committee: World Data Center-B (Moscow), Catalog, as quoted in the Lock and McElhinny (1991) database.

Khramov, A.N., 1986, Paleomagnetic directions and pole positions: Data for the USSR - Issue 6, Soviet Geophysical Committee: World Data Center-B (Moscow), Catalog, as quoted in the Lock and McElhinny (1991) database.

Khotin, M.Yu., 1976, Effusive-tuffaceous-siliceous formations of Kamchatka Cape: Nauka, Moscow, 196 p (in Russian).

Khubunaya, S.A., 1981, Nature of basalt of the Kronotskiy Peninsula (Eastern Kamchatka): Vulkanologiya i Seismologiya, no. 2, p. 36-48 (in Russian).

Kim, B. I., 1986, Structural continuation of the rift valley of Gakkel Ridge on the Laptev shelf, *in* Egiazarov, B.K., and Kazmin, Y.B., eds., Structure and History of Development of the Arctic Ocean: PVO Sevmorgeologiya, Leningrad, p. 133-139.

Kiminami, K., 1975, Sedimentology of the Nemuro Group, Part 1: Geological Society of Japan Journal, v. 81, p. 215-232.

Kiminami, K., 1983, Sedimentary history of the Late Cretaceous-Paleocene Nemuro Group, Hokkaido, Japan: A forearc basin of the Paleo-Kuril arc-trench system: Geological Society of Japan Journal, v. 89, p. 607-624.

Kiminami, K., and Kontani, Y., 1983, Sedimentology of the Saroma Group, northern Tokoro Belt, Hokkaido, Japan: Earth Science, v. 37, p. 38-47 (in Japanese with English abstract).

Kiminami, K., Miyashita, S., Kimura, G., Tajika, J., Iwata, K., Sakai, A., Yoshida, A., Kato, Y., Watanabe, Y., Esaki, Y., Kontani, Y., and Katsushima, T., 1986, Mesozoic rocks in the Hidaka belt--Hidaka Supergroup: Association for Geological Collaboration in Japan Monograph 31, p. 137-155 (in Japanese with English abstract).

Kirillova, G.L., and Makhinin, A.V., 1983, Ranks of geologic bodies of the surificial level' of material organization: Tikhookeanskaya Geologiya, no. 3, p. 73-80 (in Russian).

Kirillova, G.L., and Turbin, M.T., 1979, Formations and tectonics of the Dzhagdinsk Zone of the Mongol-Okhotsk foldbelt: Nauka, Moscow, 114 p. (in Russian).

Kirschner, C.W., 1988. Map showing sedimentary basins of onshore and continental shelf areas: U.S. Geological Survey Miscellaneous Investigations Series Map I-873, 1 sheet, scale 1:2,500,000.

Kirschner, C.W., 1994, Map showing sedimentary basins in Alaska, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America, v. G1, plate 7, scale 1:2,500,000.

Kito, N., Kiminami, K., Niida, K., Kanie, Y., Watanabe, T., and Kawaguchi, M., 1986, The Sorachi Group and the Yezo Supergroup: Late Mesozoic ophiolites and forearc sediments in the axial zone of Hokkaido, Association for Geological Collaboration in Japan Monograph 31, p. 81-96 (in Japanese with English abstract).

Klepacki, D.W., 1983, stratigraphic and structural relations of the Milford, Kaslo and Slocan groups, Roseberry Quadrangle, Lardeau map-area, British Columbia, *in* Current research, Part A: Geolgical Survey of Canada Paper 1A, p. 229-233.

Kogan, A.I., 1981, Soviet marine seismic investigations in the Chukchi Sea, *in* Marine Geophysical Investigations in the Arctic: U.S.S.R. Academy of Sciences, Leningrad, p. 38-41 (in Russian).

Kojima, S., 1989, Mesozoic terrane accretion in Northeastern China, Sikhote Alin and Japan regions: Palaeogeography, Palaeoclimatology, and Palaeoecology, v. 69, p. 213-232.

Kojima, S., Wakita, K., Okamura, Y., Natal'in, B.A., Zyabrev, S.V., Zhang, Q.L., and Shao, J.A., 1991, Mesozoic radiolarians from the Khabarovsk complex, eastern USSR: their significance in relation to Mino terrane, central Japan: Journal of Geological Society of Japan, v. 97, p. 549-551.

Komar, V.A., and Rabotnov, V.T., 1976, Upper Precambrian of northeastern U.S.S.R.: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 8, p. 5-16 (in Russian).

Komatsu, M., Kimura, G., and Kiminami, K., 1981, Tectonics of Hokkaido, with special reference to the Hidaka metamorphic belt, *in* Hara, I., ed., Tectonics of pared metamorphic belts: Tanishi, Hiroshima, p. 55-59.

Komatsu, M., Miyashita, S., Maeda, J.I., Osanai, Y., and Toyoshima, T., 1983, Exposure of a deep section of continental type crust overthrust during the final collision of arcs in Hokkaido, northern Japan, *in* Hashimoto, M., and Uyeda, S., eds., Accretion Tectonics in the Circum-Pacific Region: Proceedings of the Oji International Seminar on Accretion Tectonics, Japan, 1981: Advances in Earth and Planetary Sciences, Terra Scientific Publishing Co., Tokyo, p. 149-165.

Kontani, Y., Kiminami, K., Tajika, J., and Maniwa, K.,1986, Cretaceous sedimentary rocks in the Tokoro and Nemuro belts, Hokkaido, Japan: Association for Geological Collaboration in Japan Monograph 31, p. 157-171 (in Japanese with English abstract).

Koporulin, V.I., 1979, Accumulation conditions and lithogenesis of Lower Cretaceous deposits of the Zyryanka basin: Nauka, Moscow, 180 p. (in Russian).

Kornev, O.S., Neverov, Yu. L., Ostapenko, V.F., Zhigulyov, V.V., Kichina, Yu. N., Krasny, M.L., and Khomyakov, V.D., 1982, Results of geologic dredging in the Sea of Okhotsk by SRV Pegas (21st cruise), *in* Geologic Structure of the Sea of Okhotsk Region: Far Eastern Branch, U.S.S.R. Academy of Sciences, Vladivostok, p. 36-51. (in Russian).

Korol'kov, V.G., Rudnik, V.A., and Sobotovich, E.V., 1974, On the late Paleozoic to Early Archean age of ancient rocks in the Okhotsk median massif: Doklady Akademii Nauk SSSR, v. 219, no. 6, p. 1441-1443 (in Russian).

Kos'ko, M. K., 1984, East Siberian Sea, *in* Gramberg, I. S., and Pogrebitsky, Y. E., eds., Geologic structure of the U.S.S.R. and regularities in the distribution of mineral resources: Seas of the Soviet Arctic: Nedra, Leningrad, v. 9, p. 60-67 (in Russian).

Kos'ko, M. K., 1988, Sedimentary basins of the East Siberian and Chukchi Seas, *in* Gramberg, I. S., ed., Geology of Seas and Oceans: Sevmorgeologiya, Leningrad, p. 188-195 (in Russian).

Kos'ko, M.K., Cecile, M.P., Harrison, J.C., Ganelin, V.G., Khandoshko, N.V., and Lopatin, B.G., 1993, Geology of Wrangel Island between Chukchi and East Siberian Seas, northeastern Russian: Geological Survey of Canada Bulletin 461, 101 p.

Kos'ko, M.K., Lopatin, B.G., and Ganelin, V.G., 1990, Major geological features of the islands of the East Siberian and Chukchi Seas and the northern coast of Chukotka: Marine Geology, v. 93, p. 349-367.

Kossovskaya, A.G., 1962, Mineralogy of the Mesozoic terrigenous complexes of the Vilyui basin and West Verkhoyanye: Nauka, Moscow, 218 p. (in Russian).

Kosygin, Yu. A., ed., 1985, Tectonic map of oil and gas areas of the Far East and adjacent territories: Institute of Tectonics and Geophysics, Far Eastern Branch, U.S.S.R. Academy of Sciences, Khabarovsk, 9 sheets, scale 1:2,500,000 (in Russian).

Kovalenko, D.V., 1992, Geology and paleomagnetism of the NW framework of Bering sea region: Dissertation for degree of Candidate of Science, Institute of the Lithosphere,. Russian Academy of Sciences, Moscow, 24 p. (in Russian).

Kovalenko, S.V., and Davydov, I.A., 1990, New data on the structure and age of the Sikhote-Alin ancient metamorphic complexes: Doklady Akademii Nauk SSSR, v. 315, no. 4, p. 929-933 (in Russian).

Kozlovsky E.A., ed., 1988, Geology of the BAM Zone, geological structure: Nedra, Leningrad, 443 p. (in Russian).

Krasny, L.I., ed., 1966, Geological description of the Khabarovsk Territory and Amur Region: Geology of the U.S.S.R., v. 19,: Nedra, Moscow, 736 p. (in Russian).

Krasny, L.I., ed., 1973, Magmatism: Geology of Northeastern Asia: Nedra, Leningrad, v. 3, 395 p. (in Russian).

Krasny, L. I., ed., 1991, Geologic map of the the Khabarovsk Territory and Amur Region: Far East Production and Geologic Association, Leningrad, 2 sheets, scale 1:2,500,000.

Kristoffersen, Yngve, 1990, Eurasia Basin, *in* Grantz, Arthur, Johnson, G.L., and Sweeney, J.F., eds., The Arctic Ocean Region: Geological Society of America Geology of North America, v. L, p. 365-378.

Kropachev, A.P., Strel'nikov, S.I., Kiselev, A.A., and Fedorova, N.P., 1987, Pre-Ordovician ophiolitic clastics of the Omulevka uplift: Doklady Akademii Nauk SSSR, v. 292, no. 4, p. 941-944 (in Russian).

Kubunaya, S.A., 1987, High-aluminous plagiotholeiitic formation of island arcs: Nauka, Moscow, 167 p. (in Russian).

Kudelkin, V.V., Savitsky, B.O., Karnei, T.I., and Boldyreva, V.P., 1986, Structure and evolution of the sedimentary cover, circum-Sakhalin framing of South Okhotsk Basin: Tikhookeanskaya Geologiya, no. 4, p. 3-14 (in Russian).

Kulikov, N.V., Derevskova, N.A., and Mavrinsky, Yu.S., 1988, Lithology of Cenozoic deposits, North Okhotsk sedimentary basin: Tikhookeanskaya Geologiya, no. 5, p. 59-66 (in Russian).

Kutschale, H., 1966, Arctic Ocean geophysical studies: The southern half of the Siberia Basin: Geophysics, v. 31, p. 683-710.

Kuzmin, S.P., and Shevelyov, E.K., 1990, New data on structure and age of the Kiselyovsk suite (Lower Primorye), *in* Precambrian and Phanerozoic Stratigraphy of the Transbaikal Region and the southern Far East [abs.]: Abstracts of the 14th Far East regional Interdepartment Stratigraphic Meeting, Khabarovsk, p. 175-177 (in Russian).

L'vov, A.B., 1986, Evolution of metamorphism during formation of basement of the Eastern Kamchatka folded zone (Ganal'skiy Range): Problems of evolution of the Precambrian lithosphere: Nauka, Leningrad, p. 261-271 (in Russian).

Lane, H.R., and Ormiston, A.R., 1979, Siluro-Devonian biostratigraphy of the Salmontrout River area, east-central Alaska: Geologica et Palaeontologica, v. 13, p. 39-36.

Layer, P., Parfenov, L.M., Surnin, A.A., and Timofeev, V.F., 1993, First 40Ar-39Ar dating of magmatic and metamorphic rocks of the Verkhoyansk-Kolyma Mesozoides: Doklady Akademii Nauk SSSR, v. 329, p. 621-624 (in Russian).

Lebedev, E.L., Gur'yanov, V.A., Rasskazov, Yu, P., and Chepygin, V.E., 1989, Geologic development and volcanism of the southern part of the Okhotsk-Chukotka volcanic belt: Tikhookeanskaya Geologiya, no. 8, p. 50-55 (in Russian).

Lee, D.S., 1987, Geology of Korea: Geological Society of Korea, Kyohak S.A. Publications, Seoul, 514 p.

Leitch, C.H.B., Van der Heyden, P., Godwin, C.I., Armstrong, R.L., and Harakal, J.E., 1991, Geochronometry of the Bridge River Camp, southwestern British Columbia: Canadian Journal of Earth Sciences, v. 28, p. 195-208.

Lelikov, E.P., Mishkina, I.V., and Milov, A.P., 1977, New data on age of metamorphic rocks of the Khanka massif, *in* Zimin, S.S., ed., Geology and Magmatism of the Far East: Far Eastern Science Center, U.S.S.R. Academy of Sciences, Vladivostok, p. 16-18 (in Russian).

Lock, J., and McElhinny, M.W., 1991, The Global Paleomagnetic Data Base: Kluwer Academic Publishers, Dordrecht, 491 p.

Lomtev V.L., and Patrikeev V.N., 1965, Pressure structures in the Kuril and Japan trenches: Far Eastern Branch, U.S.S.R. Academy of Sciences, Vladivostok, 147 p. (in Russian).

Loney, R.A., and Himmelberg, G.R., 1985, Ophiolite ultramafic rocks of the Jade Mountains-Cosmos Hills area, southwestern Brooks Range, *in* Bartsch-Winkler, Susan, ed., The United States Geological Survey in Alaska: Accomplishments during 1984: U.S. Geological Survey Circular 967, p. 13-15.

Loney, R.A., Brew, D.A., Muffler, L.J.P., and Pomeroy, J.S., 1975, Reconnaissance geology of Chichagof, Baranof, and Kruzof Islands, Alaska: U.S. Geological Survey Professional Paper 792, 105 p.

Loney, R.A., and Himmelberg, G.R., 1988, Ultramafic rocks of the Livengood terrane, *in* Galloway, J.P., and Hamilton, T.D., eds., Geologic Studies in Alaska by the United States Geological Survey during 1987: U.S. Geological Survey Circular 1016, p. 62-70.

Loney, R.A., and Himmelberg, G.R., 1989, The Kanuti ophiolite, Alaska: Journal of Geophysical Research, v. 94, p. 15,869-15,900.

Luchitskaya, M.V., and Richter, A.V., 1989, Tectonic foliation of metamorphic formations of the Ganalsk Block (Kamchatka): Geotektonika, no. 23, p. 147-154 (in Russian).

Lull, J.S., and Plafker, George, 1990, Geochemistry and paleotectonic implications of metabasaltic rocks in the Valdez Group, southern Alaska: U.S. Geological Survey Bulletin 1946, p. 29-38.

Lund, Karen, and Snee, L.W., 1988, Metamorphism, structural development, and age of the continent-island-arc juncture in west-central Idaho, *in* Ernst, W.G., ed., Metamorphism and crustal evolution, western conterminous United States (Rubey Volume VII): Geological Society of America, p. 296-337.

Lychagin, P.P., Byalobzhesky, S.G., Kolyasnikov, Yu.A., Korago, E.A., and Likman, V.B., 1991, Geology and petrography of the Gromandensko-Vuruveemskiy gabbro-norite massif, South Anyui folded zone: U.S.S.R. Academy of Sciences, Magadan, 45 p. (in Russian).

Lychagin, P.P., Byalobzkesky, S.G., Kolyasnikov, Yu.A., and Likman, V.B., 1991, Magmatic history of the South Anyui folded zone: Geology of transition continent-ocean zone in northeastern Asia: U.S.S.R. Academy of Sciences, Magadan, p. 140-157 (in Russian).

Lychagin, P.P., Dylevsky, E.F., Shpikerman, V.I., and Likman, B.V., 1989, Magmatism of the central region of the northeastern U.S.S.R.: U.S.S.R. Academy of Sciences, Vladivostok, 120 p. (in Russian).

Lychagin, P.P., Merzlyakov, V.M., Ponomareva, L.G., and others, 1975, Glaucophane schist metamorphism of the Alazeya Plateau: Materials on the geology and mineral deposits of the northeastern U.S.S.R.: U.S.S.R. Academy of Sciences, Magadan, v. 22, p. 112-119 (in Russian).

Lychagin, P.P., Merzlyakov, V.M., and Terekhov, M.I., 1977, Geology of Alazeya plateau: Geology of central massifs in the northeastern U.S.S.R.: U.S.S.R. Academy of Sciences, Magadan, p. 18-55 (in Russian).

Lyttle, N.A., and Clarke, D.G., 1975, New analyses of Eocene basalt from the Olympic Peninsula, Washington: Geological Society of America Bulletin, v. 86, p. 421-427.

MacKevett, E.M., Jr., 1978, Geologic map of the McCarthy quadrangle, Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-1032, scale 1:250,000.

MacLeod, N.S., Walker, G.W. and McKee, E.H., 1976, Geothermal significance of eastward increase in age of upper Cenozoic rhyolitic domes in southeastern Oregon, *in* United Nations Symposium on the development and use of geothermal resources: U.S. Government Printing Office, Washington D.C., v. 1, p. 465-474.

Maeda, J., 1990, Opening of the Kuril basin deduced from the magmatic history of Central Hokkaido, North Japan: Tectonophysics, v. 174, p. 235-255 (in Russian).

Maekawa, H., 1983, Submarine sliding deposits and their modes of occurrence of the Kamuikotan metamorphic rocks in the Biei area, Hokkaido, Japan: Journal of the Faculty of Science, Hokkaido University, Sapporo, Japan, v. 20, p. 489-507.

Magloughlin, J.F., 1986, Metamorphic petrology, structural history, geochronology, tectonics, and geothermometry/geobarometry in the Wenatchee Ridge area, North Cascades, Washington: Seattle, University of Washington., M.S. thesis, 344 p.

Mahoney, J.B., and Journeay, J.M., 1993, The Cayoosh assemblage, southwestern British Columbia: last vestige of the Bridge River ocean, *in* Current Research, Part A: Geological Survey of Canada Paper 93-1A, p. 235-244.

Maiboroda, A.A., and Sharueva, L.I., 1979, Composition of Jurassic deposits in the western part of the Ulbansk basin, Primorye, *in* Sedimentary and volcanosedimentary formations of the Far East: U.S.S.R. Academy of Science, Vladivostok, p. 27-36 (in Russian).

Mair, J.A., and Lyons, J.A., 1981, Crustal structure and velocity anistrophy beneath the Beaufort Sea: Canadian Journal of Earth Science, v. 18, p. 724-741.

Mammerick, Jacqueline, 1991, Bathymetry of the North Pacific Ocean, *in* Winterer, E.L., Hussong, D.M., and Decker, R.W., eds., The eastern Pacific Ocean and Hawaii: Geological Society of America, Geology of North American, v. N., plate 1, scale 1:6,442,194.

Markevich, P.V., 1978, Flysch formations of the northwestern part of the Pacific foldbelt: Nauka, Moscow, 143 p. (in Russian).

Markov, M.S., and Nekrasov, G.E., 1979, Ophiolites from rift zones of the ancient continental crust (Pekul'ney Range, Chukotka), *in* Tectonics of the Earth's crust and thrusts: Nauka, Moscow, p. 81-92 (in Russian).

Markov, M.S., Puscharovskiy, Yu. M., and Til'man, S.M., eds., 1980, Tectonics of continental margins in the Pacific Northwest: Nauka, Moscow, 285 p. (in Russian).

Markovsky, B.A., and Bogdanov, G.V., 1985, Ultramafic volcanic province of Pekul'ney Ridge, northeastern U.S.S.R.: Sovetskaya Geologiya, no. 6, p. 117-126 (in Russian).

Marquis, G. and Globerman, B.R., 1988, Northward motion of the Whitehorse Trough, Paleomagnetic evidence from the Upper Cretaceous Carmacks Group: Canadian Journal of Earth Sciences, v. 25, p. 2,005-2,016.

Martin, A.J., 1970, Structure and tectonic history of the western Brooks Range, De Long Mountains and Lisburne Hills, northern Alaska: Geological Society of America Bulletin, v. 81, p. 3605-3622.

Martynov Yu.A., 1994, The importance of Al_2O_3 for chemical systematic of basaltic rocks. Tikhookeanskaya Geologiya, no. 2, p. 94-99 (in Russian).

Martynov Yu.A., and Levashov G.B., 1988, Geochemical criteria of the rift origin of Pliocene-Pleistocene basalt from the East Sikhote-Alin: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 303, p.472-476 (in Russian).

Martynov Yu.A., and Okamura S., 1993, Variation of Sr and Nd Isotopic ratios in Paleocene-Pleistocene basalts of the East Sikhote-Alin: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 333, p.366-369 (in Russian).

Martynyuk, M.V., Vaskin, A.F., Volsky, A.S., and others, 1983, Geologic map of the Khabarovsk Territory and the Amur Region, Khabarovsk: U.S.S.R. Ministry of Geology, 1 sheet, scale 1:500,000 (in Russian).

Massey, N.W.D., and Friday, S.J., 1989, Geology of the Alberni-Nanaimo Lakes area, Vancouver Island, *in* British Columbia Ministry of Energy, Mines, and Petroleum Resources, Geolgical Fieldwork 1988, Paper 1989-1, p.61-74.

Mathews, W.H., 1988, Neogene Chilcotin basalts in south-central British Columbia: geology, ages and geomorphic history: Canadian Journal of Earth Sciences, v. 26, p. 969-982.

Matsuoka, A., 1992, Jurassic-Early Cretaceous tectonic evolution of the Southern Chichibu terrane, southwest Japan: Palaeogeography, Palaeoclimatology, and Palaeoecology, v. 96, p. 71-88.

Mattinson, J.M., 1972, Ages of zircons from the northern Cascade Mountains, Washington: Geological Society of America Bulletin, v. 83, p. 3769-3784.

Mavrinsky, Yu.S., Baboshina, V.A., Kulikov, N.V., Kharakhinov, V.V., and Tereshchenkov, A.A., 1979, Tectonic elements of the Sea of Okhotsk, *in* New data on the geology and oil and gas on Sakhalin: VNIGRI, Ministry of Geology, Leningrad, p. 57-73. (in Russian).

May, S.D. and Grantz, Arthur, 1990, Sediment thickness in the southern Canada Basin: Marine Geology, v. 93, p. 331-347.

May, S.R., and Butler, R.F., 1986, North American Jurassic apparent polar wander: implications for plate motion, paleogeography, and Cordilleran tectonics: Journal of Geophysical Research, v. 91, p. 11,519-11,544.

Mayfield, C.F., Tailleur, I.L., and Ellersieck, Inyo, 1988, Stratigraphy, structure, and palinspastic synthesis of the western Brooks Range, northwestern Alaska, *in* Gryc, George, ed., Geology and exploration of the National Petroleum Reserve in Alaska, 1974 to 1982: U.S. Geological Survey Professional Paper 1399, p. 143-186.

Mayfield, C.F., Tailleur, I.L., Mull, C.G., and Sable, E.G., 1978, Bedrock geologic map of the south half of the National Petroleum Reserve in Alaska: U.S. Geological Survey Open-File Report 78-70-B, scale 1:500,000.

McClelland, W.C., 1992, Permian and older rocks of the southwestern Iskut River map-area, northwestern British Columbia, *in* Current Research: Geological Survey of Canada Paper 92-1A, p. 303-307.

McClelland, W.C., and Gehrels, G.E., 1990, Geology of the Duncan Canal shear zone: Evidence for Early to Middle Jurassic deformation of the Alexander terrane, southeastern Alaska: Geological Society of America Bulletin, v. 102, p. 1378-1392.

McClelland, W.C., and Gehrels, G.E., 1992, Upper Jurassic-Lower Cretaceous basinal strata along the Cordilleran margin: Implications for the accretionary history of the Alexander-Wrangellia-Peninsular terrane: Tectonics, v. 11, p. 832-835.

McClelland, W.C., Gehrels, G.E., Samson, S.D., and Patchett, P.J., 1992, Structural and geochronologic relations along the western flank of the Coast Mountains batholith: Stikine River to Cape Fanshaw, central southeastern Alaska: Journal of Structural Geology, v. 14, p. 475-489.

McClelland, W.C., Gehrels, G.E., Samson, S.D., and Patchett, P.J., 1992, Protolith relations of the Gravina Belt and Yukon-Tanana terrane in central southeastern Alaska, Journal of Geology, v. 100, p. 107-123.

McGroder, M.F., 1991, Reconciliation of two-sided thrusting, burial meatamorphism, and diachronous uplift in the Cascades of Washington and British Columbia: Geological Society of America Bulletin, v. 103, n. 2, p. 189-209.

Merzlyakov, V.M., 1971, Stratigraphy and tectonics of the Omulevka uplift: Nauka, Moscow, 151 p. (in Russian).

Merzlyakov, V.M., and Lychagin, P.P. 1979, On Ordovician volcanic rocks in connection with the problems of the Kolyma massif: Geotektonika, no. 1, p. 58-63 (in Russian).

Mikhailov, V.A., Volokhin, Yu.G., Parnyakov, V.P., and Oleinik, L.M., 1989, Age and amount of the Gorbushinsk series of the Pribrezhnaya zone in the Sikhote-Alin fold belt: Tikhookeanskaya Geologiya, no. 4, p. 70-77 (in Russian).

Mikhailov, V.A., Volokhin, Yu.G., Parnyakov, V.P., Oleinik, L.M., and Buryi, G.I., 1986, Gorbusha series of Dalnegorsk area, *in* Zakharov, Y.D., Belyaeva, G.V., and Nikitina, A.P., eds., New data on the Paleozoic and Mesozoic biostratigraphy of the southern Russian Far East: U.S.S.R. Academy of Sciences, Vladivostok, p. 28-36 (in Russian).

Mikhailov, V.A., Vrublevsky, A.A., and Yushmanov, Yu.P., 1987, Structure and conditions of nappe formation in the Pribrezhnaya zone (Primorie): Tikhookeanskaya Geologiya, no. 1, p. 83-91 (in Russian).

Miller, M.L., Bradshaw, J.Y., Kimbrough, D.L., Stern, T.W., and Bundtzen, T.K., 1991, Isotopic evidence for early Proterozoic age of the Idono Complex, west-central Alaska: Journal of Geology, v. 99, p. 209-223.

Miller, M.M., 1987, Dispersed remnants of a northeast Pacific fringing arc--Upper Paleozoic terranes of Permian McCloud faunal affinities, western U.S.: Tectonics, v. 6, p. 807-830.

Miller, R.B., and Monk, D.W., 1987, Ultramafic rocks of a fracture-zone ophiolite, North Cascades, Washington: Tectonophysics, v. 142, p. 261- 289.

Miller, R.B., 1975, Structure and petrology of the Ingalls peridotite and associated pre-Tertiary rocks, southwest of Mount Stuart, Washington: Seattle, University of Washington, M.S. thesis, 90 p.

Miller, R.B., 1980, Structure, petrology, and emplacement of the ophiolitic Ingalls Complex, north-central Cascades, Washington: Seattle, University of Washington, Ph.D. thesis, 422 p.

Miller, R.B., 1985, The ophiolitic Ingalls Complex, north-central Cascade Mountains, Washington: Geological Society of America Bulletin, v. 96., p. 27-42. .

Miller, T.P., 1989, Contrasting plutonic rock suites of the Yukon-Koyukuk basin and the Ruby geanticline, Alaska: Journal of Geophysical Research, v. 94, p. 15,969-15,989.

Miller, T.P., 1994, Pre-Cenozoic plutonic rocks in mainland Alaska, *in* Plafker, George, and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, v. G1, p. 535-554.

Minoura, K., 1990, The Pre-Cretaceous geology and tectonics of Northern Kitakami region: Pre-Cretaceous terranes of Japan, IGCP Project 224, Osaka, p.267-279.

Minoura, N., and Kato, M., 1978, Permian calcareous algae found in the Matsumae Group, Matsumae Peninsula, southwestern Hokkaido, Japan: Journal of the Faculty of Science, Hokkaido University, Sapporo, Japan, v. 18, p. 377-383.

Misch, P., 1966, Tectonic evolution of the northern Cascades of Washington State--A west-cordilleran case history, *in* A symposium on the tectonic history, and mineral deposits of the western Cordillera in British Columbia and in neighboring parts of the U.S.A.: Canadian Institute of Mining and Metallurgy, Vancouver, 1964, Special Volume 8, p. 101-148.

Misch, P., 1988, Tectonic and metamorphic evolution of the North Cascades: An overview, *in* Ernst, W. G., ed. Rubey Volume VII, Metamorphism and crustal evolution of the western United States: Prentice Hall, Englewood Cliffs, New Jersey, p. 180-195.

Mishkin, M.A., 1981, Metamorphism in the transition zone from the Asia continent to the Pacific Ocean: Nauka, Moscow, 196 p. (in Russian).

Mizutani S., 1987, Mesozoic terranes in the Japanese Islands and neighboring East Asia, *in* Leitch, E.C. and Scheibner, E., eds., Terrane accretion and orogenic belts: American Geophysical Union, Geodynamic Series, v. 19, p. 263-273.

Mizutani, S. 1990, Mino terrane: Pre-Cretaceous Terrane of Japan, IGGP Project 224, Osaka, p. 121-135.

Mizutani, S. and Kojima, S., 1992, Mesozoic radiolarian biostratigraphy of Japan and collage tectonics along the eastern continental margin of Asia: Palaeogeography, Palaeoclimatology, and Palaeoecology, v. 96, p. 3-32.

Molenaar, C.M., 1985, Depositional relations of Umpqua and Tyee Formations (Eocene), southwest Oregon: American Association of Petroleum Geologists Bulletin, v. 69, p. 1217-1229

Moll-Stalcup, E.J., 1990, Latest Cretaceous and Cenozoic magmatism in mainland Alaska: U.S. Geological Survey Open-File Report 90-84, 80 p.

Moll-Stalcup, Elizabeth, Brew, D.A., and Vallier, T.L., 1994b, Map of Latest Cretaceous and Cenozoic igneous rocks of Alaska, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America, Plate 5, scale 1:2,500,000.

Moll-Stalcup, Elizabeth, 1994, Latest Cretaceous and Cenozoic igneous rocks of Alaska, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America, v. G1, p. 589-620.

Monger, J.W.H., 1977, Upper Paleozoic rocks of the western Canadian Cordillera and their bearing on Cordilleran evolution: Canadian Journal of Earth Sciences, v. 14, p. 1832-1859.

Monger, J.W.H., 1985, Structural evolution of the southwestern Intermontane Belt, Ashcroft and Hope map areas, British Columbia, *in* Current Research, Part A: Geological Survey of Canada Paper 85-1A, p. 349-358.

Monger, J.W.H., 1989, Geology of Hope and Ashcroft map-areas: Geological Survey of Canada Maps, 41-1989, 42-1989, scale, 1:250,000.

Monger, J.W.H., 1991a, Correlation of Settler Schist with Darrington Phyllite and Shuksan Greenschist and its tectonic implications, Coast and Cascade Mountains, British Columbia and Washington: Canadian Journal of Earth Sciences, v. 28, p. 447-458.

Monger, J.W.H., 1991b, Georgia Basin Project: structural evolution of parts of southern Insular and southwestern Coast Belts, British Columbia, *in* Current Research, Part A: Geological Survey of Canada, Paper 91-1A, p. 219-228.

Monger, J.W.H., 1991c, Late Mesozoic to Recent evolution of the Georgia Strait--Puget Sound region, British Columbia and Washington: Washington Geology, v. 19, no. 4, p. 3-7.

Monger, J.W.H., 1993, Georgia Basin project--geology of Vancouver map-area, British Columbia, *in* Current Research, Part A: Geological survey of Canada Paper 93-1A, p. 149-157.

Monger, J.W.H., and Berg, H.C., 1987, Lithotectonic terrane map of western Canada and southeastern Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1874-B, 1 sheet, scale 1:2,500,000, 12 p.

Monger, J.W.H., Clowes, R.M., Price, R.A., Simony, P.S., Riddihough, R.P., and Woodsworth, G.J., 1985, Continent-Ocean transect B2, Juan de Fuca Plate to Alberta Plains, *in* Speed, R.C., coordinator, Geological Society of America, Centennial Continent-Ocean Transect, scale 1: 500,000, 2 sheets, 21 p.

Monger, J.W.H. and Irving, E., 1980, Northward displacement of north-central British Columbia: Nature, v. 285, p. 289-294.

Monger, J.W.H., Price, R.A., and Tempelman-Kluit, D.J., 1982, Tectonic accretion and the origin of the two major metamorphic and plutonic welts in the Canadian Cordillera: Geology, v.10, p. 70-75.

Monger, J.W.H., Price, R.A., and Tempelman-Kluit, D.J., 1982, Tectonic accretion and the origin of the two major metamorphic and plutonic welts in the Canadian Cordillera: Geology, v. 10, p.70-75.

Monger, J.W.H., van der Heyden, P., Journey, J.M. Evenchick, C.A., and Jahoney, J.B., 1994, Jurassic-Cretaceous basins along the Canadian Coast Belt tectonics: Their bearing on pre-mid Cretaceous sinistral displacements: Geology, v. 22, p. 175-178.

Moore, G.W., 1990, Geographic map of the Circum-Pacific region, Arctic Sheet: Circum-Pacific Council for Energy and Mineral Resources, scale 1:10,000,000.

Moore, G.W., Bogdanov, N.A., Drummond, K.J., Golovchenko, Zenia, Larson, R.L., Pittman, W.C., III, Rinehart, W.A., Sierberet, Lee, Simkin, Tom, Tilman, S.M., and Uyeda, Seiya, 1992, Plate Tectonic map of the Circum-Pacific Region, Arctic sheet: U.S. Geological Map CP-41, scale 1:10,000,000.

Moore, J.C., Byrne, T., Plumley, P.W., Reid, M., Gibbons, H., and Coe, R.S., 1983, Paleogene evolution of the Kodiak Islands, Alaska: Consequences of ridge-trench interaction in a more southerly latitude: Tectonics, v. 2, p. 265-293.

Moore, T.E, and Murphy, J.M., 1989, Nature of the basal contact of the Tozitna terrane along the Dalton Highway, northeast Tanana quadrangle, Alaska, *in* Dover, J.H., and Galloway, J.P., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1988: U.S. Geological Survey Bulletin 1903, p. 46-53.

Moore, T.E., 1992, The Arctic Alaska superterrane, *in* Bradley, D.C., and Dusel-Bacon, Cynthia, eds., Geologic studies in Alaska by the U.S. Geological Survey, 1991: U.S. Geological Survey Bulletin 2041, p. 238-244

Moore, T.E., and Mull, Gil, 1989, Geology of the Brooks Range and North Slope, *in* Nokleberg, W.J., and Fisher, M.A., eds., Alaskan Geological and Geophysical Transect: Field Trip Guidebook T104, 28th International Geological Congress, p. 107-131.

Moore, T.E., Nilsen, T.H., Grantz, Arthur, and Tailleur, I.L., 1983, Parauthochthonous Mississippian marine and nonmarine strata, Lisburne Peninsula, Alaska: U.S. Geological Survey Circular 939, p. 17-21.

Moore, T.E., and Nokleberg, W.J., 1988, Stratigraphy, sedimentology, and structure of the Wickersham terrane in the Cache Mountain area, east-central Alaska, *in* Galloway, J.P., and Hamilton, T.D., eds., Geologic Studies in Alaska by the United States Geological Survey during 1987: U.S. Geological Survey Circular 1016, p. 75-80.

Moore, T.E., Wallace, W.K., Bird, K.J., Karl, S.M., Mull, C.G., and Dillon, J.T., 1992, Stratigraphy, structure, and geologic synthesis of northern Alaska: U.S. Geological Survey Open-File Report 92-330, 283 p, 1 plate, scale 1:2,500,000.

Mortensen, J.K, 1992a, Pre-mid-Mesozoic tectonic evolution of the Yukon-Tanana Terrane, Yukon and Alaska: Tectonics, v.11, p. 836-853.

Mortensen, J.K., 1992b, New U-Pb ages for the Slide Mountain Terrane in southeastern Yukon Territory, *in* Radiogenic age and isotope studies: Report 5: Geological Survey of Canada Paper 91-2, p. 167-173.

Mortimer, N. 1987, The Nicola Group: Late Triassic and Early Jurassic subduction-related volcanism in British Columbia: Canadian Journal of Earth Sciences, v. 24, p. 2521-2536.

Mudie, P.J., Stoffyn-Egli, P., and Van Wagoner, N.A., 1986, Geological constraints for tectonic models of the Alpha Ridge: Journal of Geodynamics, v. 6, p. 215-196.

Mull, C.G., 1985, Cretaceous tectonics, depositional cycles, and the Nanushuk Group, Brooks Range and Arctic Slope, Alaska, *in* Huffman, A.C., Jr., ed., Geology of the Nanushuk Group and related rocks, North Slope, Alaska: U.S. Geological Survey Bulletin 1614, p. 7-36.

Mull, C.G., Tailleur, I.L., Mayfield, C.F., Ellersieck, Inyo, and Curtis, S.M., 1982, New upper Paleozoic and lower Mesozoic stratigraphic units, central and western Brooks Range, Alaska: American Association of Petroleum Geologists Bulletin, v. 66, p. 348-362.

Muller, J.E., 1980, Chemistry and origin of the Eocene Metchosin Volcanics, Vancouver Island, British Columbia: Canadian Journal of Earth Sciences, v. 17, p. 199-209.

Muller, J.E., 1980, The Paleozoic Sicker Group of Vancouver Island, British Columbia: Geological Survey of Canada Paper 79-30, 24 p.

Murchey, Benita L., Jones, David L., Holdsworth, Brian K., and Wardlaw, Bruce R., 1988, Distribution patterns of facies, radiolarians, and conodonts in the Mississippian to Jurassic Siliceous rocks of the northern Brooks Range, Alaska: U.S. Geological Survey Professional Paper 1399, p. 697-724.

Murchey, Benita, and Harris, A.G., 1985, Devonian to Jurassic sedimentary rocks in the Angayucham Mountains of Alaska; possible seamount or oceanic plateau deposits [abs.]: Eos, v. 66, p. 1102.

Murphy, J.M., 1987, Early Cretaceous cessation of terrane accretion, northern Eek Mountains, southwestern Alaska, *in* Hamilton, T.D., and Galloway, J.P., eds., Geologic Studies in Alaska by the U.S. Geological Survey during 1986: U.S. Geological Survey Circular 998, p. 83-85.

Murphy, J.M., and Patton, W.W., Jr., 1988, Geologic setting and petrography of the phyllite and metagraywacke thrust panel, north-central Alaska, *in* Galloway, J.P., and Hamilton, T.D., eds., Geologic studies in Alaska by the U.S. Geological Survey during 1987: U.S. Geological Survey Circular 1016, p 104-108.

Mustard, P.S., 1991, Stratigraphy and sedimentation of the Georgia Basin, British Columbia and Washington State: Washington Geology, v. 19, no. 4, p. 7-9.

Nakamura E., McCulloch M.T., and Campbell I.H., 1990, Chemical geodynamics in the back-arc region of Japan based on the trace element and Sr-Nb isotopic compositions: Tectonophysics, v.174, p. 207-283.

Natal'in, B.A., 1979, Tectonic nature of the metamorphic complex on the Chukotsk Peninsula: Geologiya i Geofizika, no. 6, p. 31-38 (in Russian).

Natal'in, B.A., 1984, Early Mesozoic eugeosynclinal systems in the northern part of the Circum-Pacific: Nauka, Moscow, 136 p. (in Russian).

Natal'in, B.A., 1991, Mesozoic accretionary and collisional tectonics of the southern Far East: Tikhookeanskaya Geologiya, no. 5. (in Russian).

Natal'in, B.A., 1993, History and mode of Mesozoic accretion in southeastern Russia: The Island Arc, v. 2, p. 32-48.

Natal'in, B.A., and Alexeenko, S.N., 1989, Structure of Lower Cretaceous deposits in the basement of the Middle Amur basin: Tikhookeanskaya Geologiya, no. 1, p. 37-46 (in Russian).

Natal'in, B. and Alexeenko, S.N. 1989, Tectonics of the Sredneamursk basin basement: Far East Branch, U.S.S.R. Academy of Sciences, Vladivostock, 57 p.

Natal'in, B.A., and Chernysh, S.G., 1992, Types and history of deformation of the Middle Amur sedimentary basin: Tikhookeanskaya Geologiya, no. 6, p. 34-48 (in Russian).

Natal'in B.A. and Faure M., 1991, Geodynamics of the Asia eastern margin in the Mesozoic: Tikhookeanskaya Geologiya, v. 6, p. 3-23.

Natal'in, B.A., and Popeko, L.I., 1991, The Paleozoic of the Galamsk segment of the Mongol-Okhotsk fold belt: Tikhookeanskaya Geologiya, no. 2, p. 81-89 (in Russian).

Natal'in, B.A., Popeko, L.I., and Chobotov, S.A., 1985, Tectonics of the West Dzhagdinsk zone of the Mongol-Okhotsk fold belt: Tikhookeanskaya Geologiya, no. 2, p. 49-64 (in Russian).

Natal'in B.A., and Zyabrev, S.V., 1989, Structure of Mesozoic rocks of the Amur River Valley, Field Trip Guide Book: Far Eastern Branch, U.S.S.R. Academy of Sciences, Khabarovsk, 48 p. (in Russian).

Natapov, L.M., ed., 1984, Geologic map of the U.S.S.R: U.S.S.R. Ministry of Geology, Leningrad, scale 1:1,000,000, 128 p. (in Russian).

Natapov L.M., and Shulgina W.S., eds., 1991, Geologic map of the U.S.S.R.: U.S.S.R. Ministry of Geology, Leningrad, scale 1:1,000,000, 111 p., (in Russian).

Natapov, L.M. and Surmilova, E.P., eds., 1986, Geological map of the U.S.S.R.: U.S.S.R. Ministry of Geology, Leningrad, scale 1:1,000,000, 120 p. (in Russian).

Nazarenko, L.F., and Bazhanov, V.A., 1986, Geology of the Primorsk Territory, volumes 1-3: Far East Branch, U.S.S.R. Academy of Sciences, Vladivostok (in Russian).

Nedomolkin, V.F., 1977, Geology of Eskimos massif: Summary of Candidate of Science thesis, U.S.S.R. Academy of Sciences, Vladivostok, 16 p. (in Russian).

Nekrasov, G.E, 1976, Tectonics and magmatism of Taigonos and northwestern Kamchatka: Nauka, Moscow, 158 p. (in Russian).

Nekrasov, G.E., and Sumin, L.V., 1987, Melanocratic basement of the Pekul'ney Range and its Pb/Pb thermoisochron age, *in* Essays on the geology of northwestern sector of the Pacific tectonic belt: Nauka, Moscow, p. 183-199 (in Russian).

Nelson, J. and Bradford, J.A., 1989, Geology and mineral Deposits of the Cassiar and McDame areas, British Columbia, British Columbia Ministry of Energy, Mines and Petroeum Resources, Geological fieldwork 1988, Paper 1989-1, p. 323-338.

Nelson, J., and Mihalynuk, M., 1993, The Cache Creek ocean: closure or enclosure?: Geology, v. 21, p. 173-176.

Nelson, S.W., 1992, Ophiolitic complexes in the Gulf of Alaska: U.S. Geological Survey Open-File Report 92-20C, 10 p.

Nelson, S.W., Dumoulin, J.A., and Miller, M.L., 1985, Geologic map of the Chugach National Forest, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1645-B, 1 sheet, scale 1:250,000, 16 p.

Neustroev, A., Parfenov, L.M., and Rodionov, V.P., 1993, Paleomagnetic data and the nature of the Tas-Khayakhtakh terrane in the Verkhoyansk-Kolyma region, Geologiya i Geofizika, v. 8, p. 25-37. (in Russian).

Nevolina, S.I., and Sokarev, A.N., 1986, Paleomagnetic directions and pole positions: Data for the USSR - issue 6, as quoted in the Lock and McElhinny (1991) database.

Nichols, K.M., and Silberling, N.J., 1979, Early Triassic (Smithian) ammonites of paleoequatorial affinity from the Chulitna terrane, south-central Alaska: U.S. Geological Survey Professional Paper 1121-B, p. 1-25.

Nilsen, T.H., 1981, Upper Devonian and Lower Mississippian redbeds, Brooks Range, Alaska, *in* Miall, A.D., ed, Sedimentation and tectonics in alluvial basins: Geological Association of Canada Special Paper 23, p. 187-219.

Nilsen, T.H., 1989, Stratigraphy and sedimentology of the mid-Cretaceous deposits of the Yukon-Koyukuk basin, west-central Alaska: Journal of Geophysical Research, v. 94, p. 15,925-15,940.

Nokleberg, W.J., Aleinikoff, J.N. Lange, I.M., Silva, S.R., Miyaoka, R.T., Schwab, C.E., and Zehner, R.E., 1992, Preliminary geologic map of the Mount Hayes quadrangle, eastern Alaska Range, Alaska: U.S. Geological Survey Open-File Report 92-594, 1 sheet, scale 1:250,000, 39 p.

Nokleberg, W.J., Bundtzen, T.K., Grybeck, Donald, Koch, R.D., Eremin, R.A., Rozenblum, I.S., Sidorov, A.A., Byalobzhesky, S.G., Sosunov, G.M., Shpikerman, V.I., and Gorodinsky, M.E., 1993, Metallogenesis of mainland Alaska and the Russian Northeast: Mineral deposit maps, models, and tables, metallogenic belt maps and interpretation, and references cited: U.S. Geological Survey Open-File Report 93-339, 222 pages, 1 map, scale 1:4,000,000; 5 maps, scale 1:10,000,000.

Nokleberg, W.J., Foster, H.L., and Aleinikoff, J.N., 1989a, Geology of the northern Copper River Basin, eastern Alaska Range, and southern Yukon-Tanana Basin, southern and east-central Alaska, *in* Nokleberg, W.J., and Fisher, M.A., eds., Alaskan Geological and Geophysical Transect: Field Trip Guidebook T104, 28th International Geological Congress, p. 34-63.

Nokleberg, W.J., Grantz, Arthur, Patton, W.W., Jr., Plafker, George, Scholl, D.W., Tabor, R.W., Vallier, T.L:, Fujita, Kazuya, Natal'in, B.A., Parfenov, L.M., Khanchuk, A.I., Sokolov, S.D., Tsukanov, N.V., Natapov, L.V., Monger, J.W.H., Gordey, S.P., and Feeney, T.D., 1992, Circum-North Pacific tectonostratigraphic terrane map [abs]: 29th International Geological Congress Abstracts with Programs, v. 2, p. 153.

Nokleberg, W.J., Jones, D.L., and Silberling, N.J., 1985, Origin, migration, and accretion of Andean-type arc and island arc tectonostratigraphic terranes in the southern Mount Hayes quadrangle and adjacent areas of the eastern Alaska Range, Alaska: Geological Society of America Bulletin, v. 96, p. 1251-1270.

Nokleberg, W.J., Monger, J.W.H., and Parfenov, L.M., 1995, Mesozoic and Cenozoic tectonics of the Circum-North Pacific [abs.]: Geological Association of Canada Program with abstracts, in press.

Nokleberg, W.J., Moll-Stalcup, E.J., Miller, T.P., Brew, D.A., Grantz, Arthur, Reed, J.C., Jr., Plafker, George, Moore, T.E., Silva, S.R., and Patton, William W., Jr., 1994a, Tectonostratigraphic terrane and overlap assemblage map of Alaska: U.S. Geological Survey Open-File Report 94-194, 26 p., scale 1:2,500,000.

Nokleberg, W.J., Plafker, George, and Wilson, F.H., 1994b, Geology of south-central Alaska, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America,v. G1, p. 311-366.

Nokleberg, W.J., Plafker, George, Lull, J.S., Wallace, W.K., and Winkler, G.W., 1989b, Structural analysis of the southern Peninsular, southern Wrangellia, and northern Chugach terranes along the Trans-Alaskan Crustal Transect (TACT), northern Chugach Mountains, Alaska: Journal of Geophysical Research, v. 94, p. 4297-5320.

Nokleberg, W.J., and Winkler, G.R., 1982, Stratiform zinc-lead deposits in the Drenchwater Creek area, Howard Pass quadrangle, northwestern Brooks Range, Alaska: U.S. Geological Survey Professional Paper 1209, 22 p.

O'Brien, J.A., 1987, Jurassic biostratigraphy and evolution of the Methow Trough, southwestern British Columbia: unpublished M.Sc thesis, University of Arizona, Tucson, 150 p.

O'Brien, J.A., Gehrels, G.E., and Monger, J.W.H., 1992, U-Pb geochronology of plutonic clasts from conglomerates in the Ladner and Jackass Mountain groups and the Peninsula formation, southwestern British Columbia, *in* Current Research, Part A: Geological Survey of Canada, Paper 91-1A, p. 209-214.

Obut, A.M., 1977, ed., Ordovician and Silurian stratigraphy and fauna of the Chukotka Peninsula: Nauka, Novosibirsk, 221 p. (in Russian).

Okada, H., 1983, Collision orogenesis and sedimentation in Hokkaido, Japan, *in* Hashimoto, M., and Uyeda, S., eds., Accretion tectonics in the circum-Pacific region: Proceedings of the Oji International Seminar on Accretion Tectonics, Japan, 1981: Advances in Earth and Planetary Sciences, Tokyo, Terra Scientific Publishing Co., p. 91-105.

Okada, H., Tarduno, J.A., Nakaseko, K., Nishimura, A., Sliter, W.V., and Okada, H., 1989, Microfossil assemblages from the Late Jurassic to Early Cretaceous Nikoro pelagic sediments, Tokoro Belt, Hokkaido, Japan: Faculty of Science, Kyushyu University, Memoirs, Series D, v. 26, p. 193-214.

Okulitch A.V., 1985, Paleozoic plutonism in southeastern British Columbia: Canadian Journal of Earth Sciences, v. 22, p. 1409-1424.

Oleinik, Yu.N., 1983, Tectonic zonation of the Primorski Territory: Tikhookeanskaya Geologiya, no. 1, p. 11-19 (in Russian).

Orchard, M.J. and Danner, W.R., 1991, Paleontology of Quesnellia, *in* Smith, P.L., ed., A field guide to the paleontology of southwestern Canada: Canadian Paleontology Conference 1, Vancouver, p. 139-159.

Osanai, Y., 1985, Geology and metamorphic zoning of the Main Zone of the Hidaka Metamorphic Belt in the Shizunai River region, Hokkaido, Japan: Geological Society of Japan Journal, v. 91, p. 259-278 (in Japanese with English abstract).

Oxman, V.S., 1989, Serpentinite, metamorphic rock and olistostromes of the Chemalginsky Range, *in* Geology and mineral deposits of central part of the main metallogenic belt, Northeastern U.S.S.R.: Yakutian Scientific Center, U.S.S.R. Academy of Sciences, p. 32-48 (in Russian).

Palandzhyan, S.A., Chekhov, A.D., and Lavrova, L.D., 1982, Tectonics and ophiolites of the Pekul'ney Range (Chukotka): Tikhookeanskaya Geologiya, no. 2, p. 31-39 (in Russian).

Pallister, J.S., Budahn, J.R., and Murchey, B.L., 1989, Pillow basalts of the Angayucham terrane: Oceanic plateau and island crust accreted to the Brooks Range: Journal of Geophysical Research, v. 94, p. 15,901-15,924.

Pallister, J.S., and Carlson, Christine, 1988, Bedrock geologic map of the Angayucham Mountains, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-2024, 1 sheet, scale 1:63,360.

Palmer, A.R., 1983, The Decade of North American Geology, 1983, Geologic Time Scale: Geology, v. 11, p. 503-504.

Palmer, A.R., Egbert, R.M., Sullivan, R., and Knoth, J.S., 1985, Cambrian trilobites with Siberian affinities, southwestern Alaska [abs.]: American Association of Petroleum Geologists Bulletin, v. 69, p. 295.

Panuska, B.C., 1984, Paleomagnetism of the Wrangellia and Alexander terranes and the tectonic history of southern Alaska: Unpublished Ph.D. Dissertation, University of Alaska, Fairbanks, 197 p.

Panuska, B.C., 1985, Paleomagnetic evidence for a post-Cretaceous accretion of Wrangellia: Geology, v. 13, p. 880-883.

Panuska, B.C., Decker, J.E., and Berg, H.C., 1984, A preliminary paleomagnetic study of the Gravina-Nutzotin belt, southern and southeastern Alaska: U.S. Geological Survey Circular 868, p. 117-120.

Panuska, B.C., and Macicak, M.A., 1986, Revised paleolatitude for the Paleocene Teklanika Volcanics, Central Alaska Range, Alaska [abs.]: Eos, v. 67, p. 921.

Panuska, B.C. and Stone, D.B., 1981, Late Paleozoic paleomagnetic data for Wrangellia: resolution of the polarity ambiguity: Nature, 293, 561-563.

Panuska, B.C. and Stone, D.B., 1985, Latitudinal motion of the Wrangellia and Alexander terranes and southern Alaska superterrane, *in* Howell, D.B., ed., Tectonostratigraphic Terranes of the Circum-Pacific Region: American Association of Petroleum Geologists, Earth Series I: Circum-Pacific Council for Energy and Mineral Resources, Houston, Texas, p 109-120.

Panuska, B.C., Stone, D.B. and Turner, D.L., 1990, Paleomagnetism of Eocene volcanic rocks, Talkeetna Mountains, Alaska: Journal of Geophysical Research, v. 95, p. 6,737-6,750.

Paraketsov, K.V., and Paraketsova, G.I., 1973, Lower Cretaceous deposits of the Eropol River basin: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 209, p. 665-667 (in Russian).

Paraketsov, K.V., and Paraketsova, G.I., 1989, Stratigraphy and fauna of Upper Jurassic and Lower Cretaceous deposits in the northeastern U.S.S.R.: Nedra, Moscow, 297 p. (in Russian).

Parfenov, L.M., 1984, Continental margins and island arcs of Mesozoides of northeastern Asia: Nauka, Novosibirsk, 192 p. (in Russian).

Parfenov, L.M., 1985, The segmentation and fold dislocations of the Verkhoyansk foldbelt: Geologiya i Geofizika, no. 7, p. 12-24 (in Russian).

Parfenov, L.M. 1987, Thrusts and related melanges in the Kharaulakh Mountains: Doklady Akademii Nauk SSSR, v. 296, no. 3, p. 685-689 (in Russian).

Parfenov, L.M., 1991, Tectonics of the Verkhoyansk-Kolyma Mesozoides in the context of plate tectonics: Tectonophysics, v. 199, p. 319-342.

Parfenov, L.M., and Natal'in, B.A., 1985, Mesozoic accretion and collision tectonics of Northeastern Asia, *in* Howell, D.G., ed., Tectonostratigraphic terranes of the Circum-Pacific region: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, p. 363-374.

Parfenov L.M., and Natal'in, B.A. 1986, Mesozoic tectonic evolution of Northeastern Asia: Tectonophysics, v. 127, p. 291-304.

Parfenov, L.M., Oxman, V.S., Prokopiev, A.V., Rozhin, S.S., Timofeev, V.F., and Tret'yakov, F.F., 1989, Detailed structural studies in the Verkhoyansk region, their significance for large-scale geological mapping, *in* Tectonic investigations in connection with medium and large-scale geological mapping: Nauka, Moscow, p. 109-127 (in Russian).

Parfenov, L.M., and Prokopiev, A.V., 1993, Frontal thrust structures of the Verkhoyansk foldbelt: Geologiya i Geofizika, v. 34, no. 7, p. 23-34 (in Russian).

Parfenov, L.M., and Trushchelev, A.M., 1983, Late Triassic folding and olistostromes on the southwestern limb of the Inyaly-Debin synclinorium, their tectonic significance and nature: Geologiya i Geofizika, no. 3, p. 7-20 (in Russian).

Parfenov, L.M., Popeko, V.A., and Popeko, L.I., 1983, Major structural-material complexes of Shikotan Island and their geologic nature (Minor Kuril Islands): Geologiya i Geofizika, no. 10, p. 24-31 (in Russian).

Parfenov, L.M., Rozhin, S.S., and Tret'yakov, F.F., 1988, Character of the Adycha-Taryn fault zone (eastern Verkhoyansk): Geotektonika, no. 4, p. 90-102 (in Russian).

Parkinson, D., 1991, Age and isotopic character of Early Proterozoic basement gneisses in the southern Monashee Complex, southeastern British Columbia: Canadian Journal of Earth Sciences, v. 28, p. 1159-1168.

Parrish, R.R., Carr, S.D., and Parkinson, D.L., 1988, Eocene extensional tectonics and geochronology of the southern Omineca Belt, British Columbia and Washington: Tectonics, v. 7, p. 181-212.

Parrish, R.R., and Monger, J.W.H., 1992, New U-Pb dates from southwestern British Columbia, *in* Radiogenic age and isotope studies, Report 5: Geological Survey of Canada Paper 91-2, p. 87-108.

Parrish, R.R., and McNicoll, V., 1992, U-Pb age determinations from the southern Vancouver Island area, British Columbia, *in* Radiogenic age and isotope studies, Report 5: Geological Survey of Canada Paper 91-2, p. 79-86.

Paterson, I.A., and Harakal, J.E., 1974, Potassium-argon dating of blueschists from Pinchi Lake, central British Columbia: Canadian Journal of Earth Sciences, v. 11, p.1007-1011.

Patton, W.W., Jr., 1973, Reconnaissance geology of the northern Yukon-Koyukuk Province, Alaska: U.S. Geological Survey Professional Paper 774-A, p. A1-A17.

Patton, W.W., Jr., 1991, Deep crustal composition of the Yukon-Koyukuk basin, Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 23, p. 88.

Patton, W.W., Jr., 1992a, Ophiolitic terrane of western Brooks Range, Alaska: U.S. Geological Survey Open-File Report 92-90D, 8 p.

Patton, W.W., Jr., 1992b, Ophiolitic terrane bordering the Yukon-Koyukuk basin, Alaska: U.S. Geological Survey Open-File Report 92-90F, 8 p.

Patton, W.W., Jr., Box, S.E., Moll-Stalcup, E.J., and Miller, T.P., 1994, Geology of west-central Alaska, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America,v. G1, p. 241-270.

Patton, W.W., Jr., Moll, E.J., Dutro, J.T., Jr., Silberman, M.L., and Chapman, R.M., 1980, Preliminary geologic map of Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811-A, scale 1:250,000.

Patton, W.W., Jr., Murphy, J.M., Burns, L.E., Nelson, S.W., and Box, S.E., 1992, Geologic map of ophiolitic and associated volcanic arc and metamorphic terranes of Alaska (west of the 141st meridian): U.S. Geological Survey Open-File Report 92-20A, 1 sheet, scale 1:2,500,000.

Patton, W.W., Jr., Stern, T.W., Arth, J.G., and Carlson, Christine, 1987, New U/Pb ages from granite and granite gneiss in the Ruby geanticline and southern Brooks Range, Alaska: Journal of Geology, v. 95, p. 118-126.

Patton, W.W., Jr., Tailleur, I.L., Brosgé, W.P., and Lanphere, M.A., 1977, Preliminary report on ophiolites of northern and western Alaska, *in* Coleman, R.G., and Irwin, W.P., eds., North American ophiolites: Oregon Department of Geology and Mineral Industries Bulletin 95, p. 51-57.

Pavlis, T.L., 1983, Pre-Cretaceous crystalline rocks of the western Chugach Mountains, Alaska: Nature of the basement of the Jurassic Peninsular terrane: Geological Society of America Bulletin, v. 94, p. 1329-1344.

Pavlis, T.L., Sisson, V.B., Foster, H.L., Nokleberg, W.J., and Plafker, George, 1993, Mid-Cretaceous extension tectonics of the Yukon-Tanana terrane, Trans-Alaskan Crustal Transect (TACT), east-central Alaska: Tectonics, v. 12, 103-122.

Pavlov, V.E., 1993, Paleomagnetic directions and paleomagnetic pole positions: Data for the former USSR - Issue 8, Russian Geophysical Committee: World Data Center-B (Moscow), Catalog, as quoted in the Lock and McElhinny (1991) database.

Pechersky, D.M., 1970, Paleomagnetic studies of Mesozoic deposits of the northeast of the USSR, Izvestia, Earth Physics, n. 6, p. 69-83.

Pechersky, D.M., 1973, Paleomagnetic directions and pole positions: Data for the USSR - Issues 2 and 3, Soviet Geophysical Committee: World Data Center-B (Moscow), Catalog, as quoted in the Lock and McElhinny (1991) database.

Pessel, G.H., Reifenstuhl, R.R., and Albanese, M.D., 1987, Regional geology, Chapter 2, *in* Smith, T.E., Pessel, G.H., and Wiltse, M.A., eds., Mineral assessment of the Lime Peak-Mt. Prindle area, Alaska, v. 1, Alaska Division Geological and Geophysical Surveys, Fairbanks, Alaska, p. 2-1 to 2-41.

Petocz, R.G., 1970, Biostratigraphy and Lower Permian Fusilinidae of the upper Delta River area, east-central Alaska Range, Geological Society of America Special Paper 130, 94 p.

Peyve, A.A., 1984, Composition and structural position of ophiolites of the Koryak Ridge: Nauka, Moscow, 99 p. (in Russian).

Phillips, R.L., Grantz, Arthur, Mullen, M.W., McLaughlin, M., and Selkirk, T.L., 1992, Summary of the lithostratigraphy, stratigraphic correlation, and microfauna occurrences in piston cores from Northwind Ridge, Arctic Ocean: U.S. Geological Survey Open-File Report 92-426, 110 p.

Pinus, G.V., and Sterligova, V.E., 1973, A new alpine-type hyperbasite belt in the northeastern U.S.S.R.: Geologiya i Geofizika, no. 14, p. 109-111 (in Russian).

Piskunov B.N., 1987. Geologic and petrologic characteristics of island-arc volcanicity: Nauka, Moscow, 237 p. (in Russian).

Plafker, George, 1987, Regional geology and petroleum potential of the northern Gulf of Alaska continental margin, chapter 11, *in* Scholl, D.W., Grantz, Arthur, and Vedder, J.G., eds., Geology and resource potential of the continental margin of western North America and adjacent ocean basins--Beaufort Sea to Baja California, v. 6 of Circum-Pacific Council for Energy and Mineral Resources Earth Science Series: Houston, Texas, p. 229-268.

Plafker, George, 1990, Regional geology and tectonic evolution of Alaska and adjacent parts of the northeast Pacific Ocean margin: Proceedings of the Pacific Rim Congress 90, Australasian Insitute of Mining and Metallurgy, Queensland, Australia, p. 841-853.

Plafker, George, and Berg, H.C., 1994, Overview of the geology and tectonic evolution of Alaska, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, v. G1, p. 989-1022.

Plafker, George, Blome, C.D., and Silberling, N.J., 1989a, Reinterpretation of lower Mesozoic rocks on the Chilkat Peninsula, Alaska, as a displaced fragment of Wrangellia: Geology, v. 17, p. 3-6.

Plafker, George, Gilpin, L., and Lahr, J.C., 1994, Neotectonic map of Alaska, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America, v. G1, plate 12, 1 sheet, scale 1:2,500,000.

Plafker, George, Nokleberg, W.J., and Lull, J.S., 1989b, Bedrock geology and tectonic evolution of the Wrangellia, Peninsular, and Chugach terranes along the Trans-Alaskan Crustal Transect in the northern Chugach Mountains and southern Copper River basin, Alaska: Journal of Geophysical Research, v. 94, p. 4255-4295.

Plumley, P.W., 1984, A paleomagnetic study of the Prince William terrane and the Nixon Fork terrane, Alaska: Ph.D. Dissertation, University of California, Santa Cruz, 190 p.

Plumley, P.W. and Vance, M., 1988, Porcupine river basalt field, NE Alaska, age, paleomagnetism ant tectonic significance [abs.]: Eos, v. 69, p. 1458.

Plumley, P.W., Coe, R.S., and Byne, T., 1983, Paleomagnetism of the Paleocene Ghost Rocks formation, Prince William Terrane, Alaska: Tectonics, v. 2, p. 295-311.

Polubotko, I.V., Paraketsov, K.B., and Repin, Yu.S., 1977, Jurassic structural-stratigraphic areas in the northeastern U.S.S.R.: Materials on the geology and mineral resources of the U.S.S.R. Northeast: U.S.S.R. Academy of Sciences, Magadan, v. 23, p. 42-51 (in Russian).

Popolitov, E.I., and Volynets, O.V., 1981, Geochemical features of Quaternary volcanism of the Kuril-Kamchatka island arc and some aspects of petrogenesis: Nauka, Novosibirsk, 182 p. (in Russian).

Potter, C.J., 1983, Geology of the Bridge River Complex, southern Shulaps Range, British Columbia: A record of Mesozoic convergent tectonics: unpublished Ph.D. thesis, University of Washington, Seattle, 192p.

Prokopiev, A.V., 1989, Kinematics of Mesozoic folding in the western part of the south Verkhoyan'ye: Yakutsk Science Center, U.S.S.R. Academy of Sciences, 128 p. (in Russian).

Pushcharovskiy, Yu.M., and Til'man, S.M., eds., 1982, Essays on tectonics of the Koryak Highland: Nauka, Moscow, 219 p. (in Russian).

Radzivill, A.Ya., 1972, New data on Paleozoic stratigraphy in the Bol'shoy Anyui river Area, *in* Materials on the geology and mineral deposits of the northeastern U.S.S.R.: U.S.S.R. Academy of Sciences, Magadan, v. 20, p. 73-75 (in Russian).

Ramanchuk, T.V., and Maiboroda, A.F., 1974, Some new data on the biostratigraphy of Permian deposits of the Badzhal anticlinorium, *in* Belyaeva, G.B., ed., The Paleozoic of the Far East: Institute of Tectonics and Geophysics, U.S.S.R. Academy of Sciences, Vladivostok, p. 201-213 (in Russian).

Rau, W.W., 1963, Foraminifera from the northern Olympic Peninsual Washington: U.S. Geological Survey Professional Paper, 374-G, 33 p.

Rau, W.W., 1967, Geology of the Wynooche Valley quadrangle: Washington Department of Natural Resources Bulletin, v. 56, 51 p.

Ray, G.E. 1986, The Hozameen fault system and related Coquihalla serpentinite belt of southwestern British Columbia: Canadian Journal of Earth Sciences, v. 23, p. 1022-1041.

Raznitsin Yu.N., 1982, Ophiolite allochthons and adjacent deep-water basins in the Western Pacific: Nauka, Moscow, 108 p. (in Russian).

Raznitsyn, Yu.N., Khubunaya, S.A., and Tsukanov, N.V., 1985, Tectonics of the eastern Kronotskiy Peninsula and associated basalts in Kamchatka: Geotektonika, no. 1, p. 88-101 (in Russian).

Read P.B., and Okulitch, A.V., 1977, The Triassic unconformity of south-central British Columbia: Canadian Journal of Earth Sciences, v. 14, p. 606-638.

Read, P.B., 1992, Geology of parts of Riske Creek and Alkali Lake areas, British Columbia, *in* Current Research, Part A: Geolgical Survey of Canada Paper 92-1A, p. 105-112.

Read, P.B., and Wheeler, J.O., 1976, Lardeau west half, map and marginal notes: Geological Survey of Canada, Open File Report 432, scale 1:125000.

Reed, B.L., and Nelson, S.W., 1980, Geologic map of the Talkeetna quadrangle, Alaska: U.S. Geological Survey Miscellaneous Investigations Map I-1174A, 15 p., scale 1:250,000.

Reed, J.C., Jr., Wheeler, J.O., Tucholke, B.E., and Palmer, A.R., compilers, in press, Geologic map of North America: Geological Society of America, Geology of North America, 2 sheets, scale 1:5,000,000.

Research Group on the Tokoro Belt, 1984, Petrographic constitution of the Nikoro Group and the significance of the unconformity at the base of the Saroma Group, Tokoro belt, Hokkaido, Japan: Earth Science, v. 38, p. 408-419.

Richards, D.R., Butler, R.F., and Harms, T.A., 1993, Paleomagnetism of the late Paleozoic Slide Mountain terrane, northern and central British Columbia: Canadian Journal of Earth Sciences, v. 30, p 1898-1913.

Richards, M.A., Jones, D.L., Duncan, R.A., and DePaolo, D.J., 1991, A mantle plume initiation model for the formation of Wrangellia and other oceanic flood basalt plateaus: Science, v. 254, p. 263-267.

Richter, D.H., 1976, Geologic map of the Nabesna quadrangle, Alaska: U.S. Geological Survey Miscellaneous Investigations Map Series I-932, scale 1:250,000.

Richter, D.H., Lanphere, M.A., and Matson, N.A., Jr., 1975, Granitic plutonism and metamorphism, eastern Alaska Range, Alaska: Geological Society of America Bulletin, v. 86. p. 819-829.

Ricketts, B., Evenchick, C.A., Murphy, D.C., Anderson, R.G., and Murphy, D.C., 1992, Bowser Basin, northern British Columbia: Constraints on the timing of initial subsidence and Stikinia/North American terrane interactions: Geology, v. 20, p. 1119-1122.

Riehle, J.R., Brew, D.A., and Lanphere, M.A., 1989, Geologic map of the Mount Edgecumbe volcanic field, Kruzof Island, southeastern Alaska: U.S. Geological Survey Miscellaneous Field Investigations Map I-1983, scale 1:63,360.

Rikhter A.V., 1986, The structure and tectonic evolution of Sakhalin Island in Mesozoic time: Nauka, Moscow, 90 p. (in Russian).

Rikhter, A.V., 1991, Structure of metamorphic complexes in the Ganalskiy Range, Kamchatka: Geotektonika, no. 11, p. 98-108 (in Russian).

Roe, J.R., and Stone, D.B., 1993, Paleomagnetismof the Fairbanks basalts, interior Alaska in Solie, D.N. and Tannian, F., eds., Short Notes on Alaskan Geology: Alaska Division of Geological and Geophysical Surveys Professional Report 113, p 61-69.

Roeske, S.M., Mattinson, J.M., and Armstrong, R.L., 1989, Isotopic ages of glaucophane schists on the Kodiak Islands, southern Alaska, and their implications for the Mesozoic tectonic history of the Border Ranges fault system: Geological Society of America Bulletin, v. 101, p. 1021-1037.

Roganov, G.V., Sobolev, L.P. and others, 1986, Uda-Shantarsk phosphorite-bearing basin: Nauka, Novosibirsk, 168 p. (in Russian).

Ross, C.A., 1969, Upper Paleozoic Fusilinacea: Eowaeringella and Weedekindellina from Yukon Territory and giant Parafusulina from British Columbia: Geolgical Survey of Canada Bulletin 182 (Contributions to Canadian Paleontology), p.129-134.

Ross, C.A. and Ross, J.R.P., 1983, Late Paleozoic accreted terranes of North America, *in* Stevens, C.H., ed., Pre-Jurassic rocks in western North American suspect terranes: Society of Economic Paleontologists and Mineralogists, Pacific Section, p. 7-22.

Ross, G.M., 1991, Precambrian basement in the Canadian Cordillera: An introduction: Canadian Journal of Earth Sciences, v. 28, p. 1133-1139.

Rozhdestvensky V.S., 1983, Lithostratigraphy of Mesozoic and Paleozoic deposits of the East Sakhalin Mountains: Tikhookeanskaya Geologiya, no. 5, p. 48-57 (in Russian).

Rozogov, Yu.I., and Vasil'eva, N.M., 1968, Coastal Devonian deposits on Long straight bank, central Chuktoka, *in* Uchenye Zapiski, Regional'naya Geollogiya, no. 13: NIIGA, Ministry of Geology, Leningrad, p. 151-157. (in Russian).

Rubin, C.M., Miller, M.M., and Smith, G.M., 1991, Tectonic development of Cordilleran mid-Paleozoic volcano-plutonic complexes: Evidence for convergent margin tectonism, *in* Harwood, D.S., and Miller, M.M., eds., Paleozoic and early Mesozoic paleogeographic relations of the Sierra Nevada, Klamath Mountains, and related terranes: Geological Society of America Special Paper 225, p. 1-16.

Rubin, C.M., and Saleeby, J.B., 1991, Tectonic framework of the upper Paleozoic and lower Mesozoic Alava sequence: A revised view of the polygenetic Taku terrane in southern southeast Alaska: Canadian Journal of Earth Sciences, v. 28, p.881-893.

Rubin, C.M., Saleeby, J.B., Cowan, D.S., Brandon, M.T., and McGroder, M.F., 1990, Regionally extensive mid-Cretaceous west-vergent thrust system in the northwestern Cordillera: Implications for continent-margin tectonism: Geology, v. 18, p. 276-280.

Rudenko, V.S., and Panasenko, E.S., 1990, Permian radiolaria of the Pantovy Creek member of the Primorye region, *in* Zakharov, Y.D., Belyaeva, G.V., and Nikitina, A.P., eds., New data on the Paleozoic and Mesozoic biostratigraphy of the southern Russian Far East: U.S.S.R. Academy of Sciences, Vladivostok, p. 181-193 (in Russian).

Rusakov, I.M., Florova, Z.B., Bondarenko, N.S., and others, 1977, Stratigraphy of Mesozoic deposits of the Alzaeya Plateau: Geologiya i Geofizika, no. 8, p. 129-133 (in Russian).

Rusakov, I.M., Kats, A.G., Bondarenko, N.S., and others, 1975, New data on the Paleozoic stratigraphy of the Alazeya Plateau: Doklady Akademii Nauk SSSR, v. 223, no. 1, p. 178-181 (in Russian).

Rusmore, M.E., 1987, Geology of the Cadwallader Group and the Intermontane-Insular superterrane boundary, southwestern British Columbia: Canadian Journal of Earth Sciences, v. 254, p. 2279-2291.

Rusmore, M.E., and Cowan, D.S., 1985, Jurassic-Cretaceous units along the southern edge of the Wrangellia terrane on Vancouver Island: Canadian Journal of Earth Sciences, v. 22, p. 1223-1232.

Ruzhentzev, S.V., Byalobzhesky, S.G., Grigoryev, V.N., Kazimirov, A.D., Peyve, A.A., and Sokolov, S.D., 1982, Tectonics of the Koryak Ridge, *in* Puscharovskiy, Yu.M., and Til'man, S.M., eds., Essays on the tectonics of the Koryak Highland: Nauka, Moscow, p. 136-189 (in Russian).

Ryberg, P.T., 1984, Sedimentation, structure, and tectonics of the Umpqua Group (Paleocene to Early Eocene) southwestern Oregon: unpublished Ph.D. thesis, University of Arizona, Tucson, 280 p.

Sainsbury, C.L., 1969, Geology and ore deposits of the central York Mountains, western Seward Peninsula, Alaska: U.S. Geological Survey Bulletin 1287, 101 p.

Sakai, A., and Kanie, H., 1986, Geology of the Nishicha district, Japan: Geological Survey Japan, 92 p., 1 sheet, scale 1:50,000.

Sakakibara, M., Niida, K., Toda, H., Kito, N., Kimura, G., Tajika, J., Katoh, T., and Yoshida, A., 1986, Research Group of the Tokoro belt: Association for Geological Collaboration in Japan Monograph 31, p. 173-187 (in Japanese with English abstract).

Saleeby, J.B., and Rubin, C.M., 1990, The East Behm Canal gneiss complex (southern southeast Alaska) and some insights into basement tectonics along the Insular suture belt [abs.]: Geological Association of Canada, Program with Abstracts, v. 15, p. A116.

Sampson, S.D., Patchett, P.J., McClelland, W.C., and Gehrels, G.E., 1991, Nd and Sr isotopic constraints on the petrogenesis of the west side of the northern Coast Mountains batholith, Alaskan and Canadian Cordillera: Canadian Journal of Earth Sciences, v. 28, p. 939-946.

Savostin L.A., and Drachiov, S.S., 1988, Cenozoic compression in the region of the Novosibirskie Islands and the relationship with rifting: Okeanologiya, no. 28, p. 775-781 (in Russian).

Savostin, L.A., and Drachev, S.S., 1988, Some features of the geologic structure and tectonics of southern Bol'shoi Lyakhov Island (New Siberian Islands): Doklady Akademii Nauk SSSR, v. 301, p. 169-172 (in Russian).

Savostin, L.A., and Kheyfets, A.M., 1989, Paleomagnetic directions and pole positions: Data for the USSR - Issue 7, Soviet Geophysical Committee: World Data Center-B (Moscow), Catalog, as quoted in the Lock and McElhinny (1991) database.

Savostin, L.A., Silant'ev, S.A., and Bogdanovsky, O.G., 1988, New data on the volcanism of Zhokhov Island (De Long Archipelago, Arctic Basin): Doklady Akademii Nauk SSSR, v. 302, p. 1443-1447 (in Russian).

Scammell, R.J., and Brown, R.L., 1990, Cover gneisses of the Monashee Terrane: A record of synsedimentary rifting in the North American cordillera: Canadian Journal of Earth Sciences, v. 27, p. 712-726.

Scheglov, S.B., 1984, Volcanic belts of eastern Asia: Geology and Metallogeny, Nauka, Moscow, 504 p. (in Russian).

Schiarrizza, P., Gaba, R.G., Coleman, M., Garver, J.I. and Glover, J.K., 1990, Geology and mineral occurrences of the Yalakom River area, *in* Geological Fieldwork 1989: British Columbia Ministry of Energy, Mines and Petroleum Resources Paper 1990-1, p. 53-72.

Shilo, N.A., ed., 1982, Decisions of third interdepartment regional stratigraphic meeting on the Precambrian and Phanerozoic of the U.S.S.R. Far East, 1978: U.S.S.R. Academy of Sciences, Magadan, 181 p. (in Russian).

Scholl, D.W., and Hart, P.E., 1994, Velocity and amplitude structures on sesimic reflection profiles--possible massive gas-hydrate deposits and underlying gas accumulations in the Bering Sea Basin, *in* Howell, D.G., ed., The future of energy gases: U.S. Geological Survey Professional Paper 1570, p. 331-351.

Scholl, D.W., Stevenson, A.J., Mueller, S., Geist, E., Engebretson, D.C., and Vallier, T.L., 1992, Exploring the notion that southeast-Asian type escape tectonics and trench clogging are involved in regional scale deformation of Alaska and the formation of the Aleutian-Bering Sea Region, *in* Flower, M., McCabe, R., and Hilde, T., conveners, Southeast Asia Structure, Tectonics, and Magmatism: Geodynamics Research Institute, Texas A&M University, College Station, Texas, p. 57-63.

Seliverstov N.I., 1987, Seismoacouistic studies of the transition zones: Nauka, Moscow, 112 p. (in Russian).

Seliverstov N.I., Baranov B.V., Egorov Yu.O., and Shkira V.A., 1988, New data on the structure of the southern Komandorsky Basin obtained by R/V Vulkanolog (26th Cruise): Volcanology and Sedimentology, no. 4, p. 3-20 (in Russian).

Semenov D.F., 1975. Neogene magmatic formations of southern Sakhalin: U.S.S.R. Academy of Sciences, Khabarovsk, 208 p. (in Russian).

Sengör, A.M.C., Natal'in, B. A., and Burtman, V. S., 1993, Evolution of the Altaid tectonic collage and Paleozoic crustal growth in Eurasia: Nature, v. 364, p. 299-307.

Sengör, A.M.C., Natal'in, B.A. and Burtman, V.S., 1994, Tectonic evolution of the Altaid: Geology and Geophysics, v. 78, p. 41-59.

Sergeyev, K.F., and Krasny M.L., eds. 1987, Geologic and geophysical atlas of the Kuril-Kamchatka island system: VSEGEI, Ministry of Geology, Leningrad, 36 sheets (in Russian and English).

Seslavinskiy, K.B., 1970, Structure and development of the South Anyui suture basin (western Chukotka): Geotektonika, no. 4, p. 56-68 (in Russian).

Seslavinskiy, K.B., 1979, South Anyui suture (western Chukotka): Doklady Akademii Nauk SSSR, v. 249, p. 1181-1185 (in Russian).

Seslavinskiy, K.B., and Ged'ko, M.I., 1990, Ophiolitic complexes of western Chukotka and geodynamic interpretation of their genesis: Tectonics and Mineralogy of the northeastern U.S.S.R.: U.S.S.R. Academy of Sciences, Magadan, p. 191-194 (in Russian).

Shantser, A.E., Shapiro, M.N., Koloskov, A.V., and others, 1985, Structural evolution of the Lesnovsk uplift and adjacent areas in the Cenozoic (Northern Kamchatka): Tikhookeanskaya Geologiya, no. 4, p. 66-74 (in Russian).

Shapiro, M.N., 1976, Northeastern continuation of the northern part of the eastern Kamchatka anticlinorium: Geotektonika, no. 18, p. 125-129 (in Russian).

Shapiro, M.N., 1976, Tectonic development of the eastern edge of Kamchatka: Nauka, Moscow, 123 p. (in Russian).

Shapiro, M.N., Ermakov, V.A., Shantser, A.E., Shul'dner, V.I., Khanchuk, A.I., and Vysotsky, S.V., 1987, Essays on the tectonic development of Kamchatka: Nauka, Moscow, 247 p. (in Russian).

Shapiro, M.N., Slyadnev, B.I., and Lander, A.V., 1984, Imbricate-thrust structures of the northern eastern Kamchatka anticlinorium: Geotektonika, v. no, p. 84-93 (in Russian).

Shaver, Ralph and Hunkins, Kenneth, 1964, Arctic Ocean geophysical studies: Chukchi Cap and Chukchi Abyssal Plain: Deep-Sea Research, v. 11, p. 905-916.

Shcheka, S.A., Oktyabrsky, R.A., Vrzhosek, A.A., and Starkov, G.N., 1973, Basic characteristics of the evolution of the basite-hyperbasite magmatism in Primorye, *in* Magmatic Rocks, U.S.S.R. Academy of Sciences, Vladivostok, p. 9-61 (in Russian).

Shevelev, E.K., 1987, Age of the volcanogenic siliceous and terrigenous deposits of the basement of the Middle Amur basin: Tikhookeanskaya Geologiya, no. 3, p. 13-16 (in Russian).

Shevelev, E.K., and Kuzmin, S.P., 1990, New data on the stratigraphy in the Badzhal zone, *in* New data on Paleozoic and Mesozoic biostratigraphy of the southern Far East: U.S.S.R. Academy of Sciences, Vladivostok, p. 72-80 (in Russian).

Shilo, N.A., Merzlyakov, V.M., Terekhov, M.I., and Til'man, S.M., 1973, Alazeya-Oloy eugeosyncinal system--A new element of the Northeastern U.S.S.R. Mesozoides: Doklady Akademii Nauk SSSR, v. 210, no. 5, p. 1174-1176 (in Russian).

Shipilov, E. V., 1989, The graben-rift system of the Chukchi Sea: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 10, p. 96-107 (in Russian).

Shipilov E.V., Senin B.V., and Yunov A.Yu., 1989, Sedimentary mantle and basement of the Chukcha Sea from seismic data: Geofizika, p. 99-109 (in Russian).

Shishkin, V.A., 1979, Metamorphic complex of the Prikolymsk uplift: Nauka, Moscow, 111 p. (in Russian).

Shishkin, V.A., 1980, Metamorphosed hyperbasites and gabbros of the Uyandina horst (Polousnyy uplift), *in* Magmatism and metallogeny of northeastern Asia: U.S.S.R. Academy of Sciences, Magadan, 127-128 (in Russian).

Shkodzinsky, V.S., Nedosekin, Yu.D., and Surnin, A.A., 1992, Petrology of late Mesozoic magmatic rocks in eastern Yakutia: Nauka, Novosibirsk, 238 p. (in Russian).

Shmakin, V.B., 1991, New data on Upper Jurassic deposits of the Koiverelan River basin: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 4, p. 31-35 (in Russian).

Shul'diner, V.I., and Nedomolkin, V.F., 1976, Crystalline basement of Eskimos massif: Sovetskaya Geologiya, no. 10, p. 38-47 (in Russian).

Shul'diner, V.I., Vysotskiy, S.V., Khanchuk, A.I., and Shapiro, M.N., 1987, Magmatic and metamorphic rocks of the basement of island arcs and marginal seas, *in* Petrology and geochemistry of island arcs and marginal seas: Nauka, Moscow, p. 7-36 (in Russian).

Shul'gina, V.S., 1980, Carboniferous and Permian deposits in the northern realm of the Omolon massif: Geologiya i Razvedka, no. 4, p. 33-41 (in Russian).

Shul'gina, V.S., Tkachenko, V.I., and Kuznetsov, V.M., 1990, Geological map of the U.S.S.R.: U.S.S.R. Ministry of Geology, Leningrad, scale 1:1,000,000 (in Russian).

Sidorov, Yu.F., 1990, Stratigraphy of middle Paleozoic deposits of the Amgun and Kerbi Rivers (Nilansk zone), *in* Precambrian and Phanerozoic stratigraphy of the Transbaikal Region and the southern Far East: Abstracts of the 14th Far East Regional Interdepartment Stratigraphic Meeting, Khabarovsk, p. 79-81 (in Russian).

Sigov, V.F., 1973, Tectonic nature of the Bureya massif: Summary of Ph.D. thesis, U.S.S.R. Academy of Scieinces, Khabarovsk, 24 p. (in Russian).

Silberling, N.J., Jones, D.L., Blake, M.C., Jr., and Howell, D.G., 1984, Lithotectonic terrane map of the western conterminous United States, Pt. C of Silberling, N.J., and Jones, D.L., eds., Lithotectonic terrane maps of the North American Cordillera: U.S.Geological Survey Open-File Report 84-523, 43 p.

Silberling, N.J., Jones, D.L., Blake, M.C., Jr., and Howell, D.G., 1987, Lithotectonic terrane map of the western conterminous United States: U. S. Geological Survey Miscellaneous Field Investigations Map MF 1874-C, scale 1:2,500,000.

Silberling, N.J., Jones, D.L., Monger, J.W.H., and Coney, P.J., 1992, Lithotectonic terrane map of the North American Cordillera: U.S. Geological Survey Miscellaneous Investigations Series Map I-2176, 2 sheets, scale 1:5,000,000.

Silberling, N.J., Richter, D.H., Jones, D.L., and Coney, P.C., 1981, Geologic map of the bedrock part of the Healy A-1 quadrangle south of the Talkeetna-Broxson Gulch fault system, Clearwater Mountains, Alaska: U.S. Geological Survey Open-File Report 81-1288, scale 1:63,360.

Simanenko V.P., 1986, Late Mesozoic volcanic arcs of the East Sikhote Alin and Sakhalin Island: Tikhookeanskaya Geologiya, no. 1, p. 7-13 (in Russian).

Sinitsa, S.M., and Khanchuk, A.I., 1991, Primary gneiss facies in gabbroids (southern Primorye as an illustration): Doklady Akademii Nauk SSSR, v. 317, p. 1446 (in Russian).

Sisson, V.B., Hollister, L.S., and Onstott, T.C., 1989, Petrologic and age constraints on the origin of a low-pressure/high-temperature metamorphic complex, southern Alaska: Journal of Geophysical Research, v. 94, p. 4392-4410.

Sizykh, V.I., 1973, Formations, tectonic and geologic development of the Oloy folded zone: Summary of Candidate of Science thesis, U.S.S.R. Academy of Sciences, Irkutsk, 24 p. (in Russian).

Sizykh, V.I., Ignat'ev, V.A., and Shkol'nyi, L.D., 1977, New data on the stratigraphy and tectonics on the left bank of Malyi Anyui River, *in* Materials on the geology and mineral deposits of the northeastern U.S.S.R.: U.S.S.R. Academy of Sciences, Magadan, v. 23, p. 29-34 (in Russian).

Slautsitais, I.P., 1971, Paleomagnetic directions and pole positions: Data for the USSR - Issue 1, Soviet Geophysical Committee: World Data Center-B (Moscow), Catalog, as quoted in the Lock and McElhinny (1991) database.

Smith, J.G., 1993, Geologic map of upper Eocene to Holocene volcanic and related rocks in the Cascade Range, Washington: U.S. Geological Survey Miscellaneous Investigations Map I-2005, scale 1:500,000, 2 sheets, 19 p.

Smith, M.T., and Gehrels, G.E., 1991, Detrital zircon geochronology of Upper Proterozoic to lower Paleozoic continental margin strata of the Kootenay arc: Implications for the early Paleozoic tectonic development of the eastern Canadian Cordillera: Canadian Journal of Earth Sciences, v. 28, p. 1271-1284.

Smith P.L., and Tipper, H.W., 1986, Plate tectonics and paleobiogeography: Early Jurassic (Pliensbachian) endemism and diversity: Palaios, v. 1, p. 399-412.

Smith, T.E., 1981, Geology of the Clearwater Mountains, south-central Alaska: Alaska Division of Geological and Geophysical Surveys Geologic Report 60, 72 p., 1 sheet, scale 1:63,360.

Snavely, P.D., Jr., MacLeod, N.S., and Niem, A.R., 1993, Geologic map of the Cape Flattery, Clallam Bay, Ozette Lake, and lake Pleasant Quadrangles, Northwestern Olympic Peninsula, Washington: U.S. Geological Survey Miscellaneous Investigations Map MI-1946, scale 1:48,000.

Snavely, P.D., Jr., MacLeod, N.S. and Rau, W.W., 1969, Geology of the Newport area, Oregon: The Ore Bin, v. 31, no. 2 and 3, p. 25-71.

Snavely, P.D., Jr., Niem, A.R., MacLeod, N.S., Pearl, J.E., and Rau, W.W., 1980, Makah Formation--A deep marginal-basin sedimentary sequence of late Eocene and Oligocene age in the northwestern Olymlpic Peninsula, Washington: U.S. Geological Survey Professional Paper 1162-B, 28 p.

Snavely, P.D., Jr., MacLeod, N.S., and Wagner, H.C., 1968, Tholeiitic and alkalic basalts of the Eocene Siletz River Volcanics, Oregon Coast Range: American Journal of Science, v. 266, p. 454-481.

Snavely, P.D., Jr., Wagner, H.C., and Lander, D.L., 1980, Geologic cross section of the central Oregon continental margin: Geological Society of America Map and Chart Series MC-28J, scale 1:250,000.

Snavely, P.D., Jr., Wagner, H.C. and MacLeod, N.S., 1964, Rhythmic-bedded eugeosynclinal depostis of the Tyee Formation, Oregon Coast Range: Kansas Geological Survey Bulletin, v. 169, p. 461-480.

Sokolov, S.D., 1990, Exotic complexes (terranes) in the Koryak Ridge region: Proceedings of the High Educational Institutions, Geologiya i Razvedka, no. 1, p. 16-29 (in Russian).

Sokolov, S.D., 1992, Accretionary tectonics of the Koryak-Chukotka segment of the Pacific belt: Nauka, Moscow, 182 p. (in Russian).

Sokolov, S.D., Silantiev, S.A., and Polynin, Y.V., 1994, New data on metamorphic complexes of the Talovka River area, Penzhina region, Russian Northeast: Geotektonika, no. 2, p. 82-90 (in Russian).

Solov'eova, M.F., 1975, Biostratigraphic subdivision of Lower and Middle Carboniferous deposits and foraminiferas on Kotel'nyi and Wrangel Island, and Chukotka, *in* The Upper Paleozoic of the northeastern U.S.S.R.: Nauka, Leningrad, p. 42-53.

Sondergaard, J.N., 1979, Stratigraphy and petrology of the Nooksack Group in the Glacier Creek-Skyline divide area, North Cascades, Washington: unpublished M.S. thesis, Western Washington University, Bellingham, 103 p.

Sorokin, A.P., 1972, Geologic structure of pre-Mesozoic folded basement in the northwestern part of the Zeya-Bureya basin, *in* Geology of the Far East: U.S.S.R. Academy of Sciences, Khabarovsk, p. 51-156 (in Russian).

Sosunov, G.M., 1985, Geologic map of Northeast U.S.S.R.: Northeastern Production and Geological Association: U.S.S.R. Ministry of Geology, Magadan, 1 sheet, scale 1:5,000,000.

Sosunov, G.M., Pavlova, O.K., and Gel'man, M.L., 1982, Geologic map of the northeastern U.S.S.R.: U.S.S.R. Ministry of Geology, Magadan, 39 p., scale 1:1,500,000 (in Russian).

Souther, J.G., 1971, Geology and mineral deposits of Tulsequah map area, British Columbia: Geological Survey of Canada Memoir 362, 45 p.

Southwick, D.L., 1974, Geology of the alpine-type ultramafic complex near Mount Stuart, Washington: Geological Society of America Bulletin, v. 85, p. 391-402.

Spektor, V.B., Andrusenko, A.M., Dudko, E.A., and Kareva, N.F., 1981, Continuation of the South Anyui suture in the Primorian lowlands: Doklady Akademii Nauk SSSR, v. 260, p. 1447-1450 (in Russian).

Stamatakos, J., Kodama, K.P. and Pavlis, T.L., 1988, Paleomagnetism of Eocene volcanic rocks, Matanuska Valley, Alaska: Geology, v. 16, p. 618-622.

Stamatakos, J., Kodama, K.P., Vittorio, L.F. and Pavlis, T.L., 1989, Paleomagnetism of Cretaceous and Paleocene sedimentary rocks across the Castle Mountain Fault, south central Alaska, *in* Hillhouse, J.W., ed., Deep structure and past kinematics of accreted terranes: American Geophysical Union. Geophysical Monograph 50, p 151-177.

Stamatakos, J., Kodama, K.P., and Pavlis, T.L., 1986, Paleomagnetic study of Early Tertiary sediments along the Castle Mountain Fault, Matanuska Valley, Alaska [abs.]: Eos, v. 67, p. 921.

Stanley, W.D., Labson, V.F., Nokleberg, W.J., Csejtey, Béla, Jr., and Fisher, M.A., 1990, The Denali fault system and Alaska Range of Alaska: Evidence for suturing and thin-skinned tectonics from magnetotellurics: Geological Society of America Bulletin, v. 102, p. 160-173.

Stone, D.B. and Packer, D.R., 1979, Paleomagnetic data from the Alaska Peninsula: Geological Society of America Bulletin, v. 90, p. 545-560.

Stone, D.B., Harbert, W., Vallier, T., and McLean, H., 1983, Eocene Paleolatitudes for the Aleutian Islands [abs.]: Eos, v. 64, p. 87.

Stone, D.B., Panuska, B.C., and Packer, D.R., 1982, Paleolatitudes versus time for southern Alaska. Journal of Geophysical Research, v. 87, p. 3697-3707.

Stavsky, A.P., Berezner, O.S., Safonov, V.G., and Zlobin, S.K., 1989, Tectonics of the Mainits zone of the Koryak Highland: Tikhookeanskaya Geologiya, no. 3, p. 72-81 (in Russian).

Stott, D.F., and Aitken, J.D., eds., 1993, Sedimentary cover of the craton in Canada, The Geology of North America. An Overview, *in* Geological Survey of Canada, Geology of Canada, no. 5 (also in Geological Society of America, The geology of North America, v. D1), 826 p.

Struik, L.C., and Orchard, M.J., 1985, Late Paleozoic conodonts from ribbon chert delineate imbricate thrusts within the Antler Formation of the Slide Mountain terrane, central British Columbia: Geology, v. 13, p. 794-798.

Sugimoto, M., 1974, Stratigraphical study in the outer belt of the Kitakami Massif, northeastern Japan: Tohoru University, Institute of Geology and Paleontology, Contribution no.74, p. 1-48.

Sukhov, S.A., 1975, Volcanic formations of the Far East: Nauka, Moscow, 111 p. (in Russian).

Surmilova, E.P., 1980, Sedimentation characteristics of Prikolym'ye in the Devonian: Geologiya i Razvedka, no. 4, p. 41-49 (in Russian).

Symons, D.T.A., 1969a, Geological implications of paleomagnetic studies in the Bella Coola and Laredo Sound map areas, British Columbia: Geological Survey of Canada Paper 68-72, p. 15.

Symons, D.T.A., 1969b, Paleomagnetism of the Late Miocene plateau basalts in the Caribou region of British Columbia: Geological Survey of Canada Paper, 69-43, p. 15.

Symons, D.T.A., 1969c, Paleomagnetism of four late Miocene gabbroic plugs in south-central British Columbia: Canadian Journal of Earth Sciences, v. 6, p. 653-662.

Symons, D.T.A., 1973a, Paleomagnetic results from the Jurassic Topley intrusions near Endako, British Columbia: Canadian Journal of Earth Sciences, v. 10, p. 1099-1108.

Symons, D.T.A., 1973b, Paleomagnetic results from the Tertiary Mt. Barr and Hope plutonic complexes, British Columbia, Geological Survey of Canada Paper 73-19, p. 1-10.

Symons, D.T.A., 1973c, Concordant Cretaceous paleolatitudes from felsic plutons in the Canadian Cordillera: Nature Physical Sciences,v. 241, p. 59-61.

Symons, D.T.A, 1977, Paleomagnetism of Mesozoic plutons in the westernmost coast complex of British Columbia: Canadian Journal of Earth Sciences, v. 14, p. 2,127-2,139.

Symons, D.T.A., 1983, Further paleomagnetic results from the Jurassic Topley Intrusives in the Stikinia sub-terrane of British Columbia: Geophysical Research Letters, v. 10, p. 1,065-1,068.

Symons, D.T.A., 1985a, Paleomagnetism of the west coast complex and the geotectonics of the Vancouver Island segment of the Wrangellian substerrane: Journal of Geodynamics, v. 2, p. 211-228.

Symons, D.T.A., 1985b, Paleomagnetism of the Triassic Nicola volcanics and geotectonics of the Quesnellia subterrane of Terrane I, British Columbia: Journal of Geodynamics, v. 2, p. 229-244.

Symons, D.T.A., and Litalien, C., 1984, Paleomagnetism of the Lower Jurassic Copper Mountain Intrusions and the Geotectonics of Terrane I, British Columbia: Geophysical Research Letters, v. 11, p. 685-688.

Symons, D.T.A., and Wellings, M.R., 1989, Paleomagenetism of the Eocene Kamloops Group and the cratonization of Terrane I of the Canadian Cordillera: Canadian Journal of Earth Sciences, v. 26, p. 821-828.

Tabor, R.W., 1994, Late Mesozoic and possible early Tertiary accretion in western Washington State: The Helena-Haystack melange and the Darrington-Devils Mountain fault zone: Geological Society of America Bulletin, v. 106-p. 217-232.

Tabor, R.W., and Cady, W.M., 1978, Geologic map of the Olympic Peninsula: U.S. Geological Survey Miscellaneous Investigations Map I-994, scale 1:125,000.

Tabor, R.W., Booth, D.B., and Ford, A.B., in press, Geologic map of the Sauk River 30 by 60 minute quadrangle: U. S. Geological Survey Map I-____, scale 1:100,000.

Tabor, R.W., Booth, D.B., Vance, J.A., and Ort, M.H., 1988, Preliminary geologic map of the Sauk River 30 x 60 minute quadrangle, Washington: U.S. Geological Survey, Open File Report, 88-692. scale 1:100,000.

Tabor, R.W., Frizzell, V.A., Jr., Booth, D. B., Waitt, R.B., Whetten, J.T., and Zartman, R.E., 1993, Geologic map of the Skykomish 60-minute by 30-minute quadrangle, Washington: U.S. Geological Survey Miscellaneous Investigations Map I-1963, scale 1:100,000.

Tabor, R.W., Frizzell, V.A., Jr., Vance, J.A., and Naeser, C.W., 1984, Ages and stratigraphy of lower and middle Tertiary sedimentary and volcanic rocks of the Central Cascades, Washington: applications to the tectonic history of the Straight Creek fault: Geological Society of America Bulletin, v. 95, p. 26-44.

Tabor, R.W., Haugerud, R.H., and Miller, R.B., 1989, Overview of the geology of the North Cascades, *in* Tabor, R.W., Huagerud, R.H., Brown, EH., Babcock, R.S., and Miller, R.B., eds., Accreted Terranes of the North Cascades Range, Washington: American Geophyiscal Union Guidebook, 28th International Geologic Congress Field Trip T307, Washington, D.C., p. 1-33.

Tabor, R.W., Zartman, R.E., and Frizzell, V.A., Jr., 1987, Possible tectonostratigraphic terranes in the North Cascades crystalline core, Washington, *in* Schuster, E.R., ed., Selected papers on the geology of Washington: Washington State Department of Natural Resources Bulletin 77, p. 107-127.

Tailleur, I.L., Mayfield, C.F., and Ellersieck, I.F., 1977, Late Paleozoic sedimentary sequence, southwestern Brooks Range, *in* Blean, K.M., ed., The United States Geological Survey in Alaska: Accomplishments during 1976: U.S. Geological Survey Circular 751-B, p. 25-27.

Tajika, J., 1988, Stratigraphy and structure of the Upper Cretaceous Yubetsu Group, Tokoro Belt, eastern Hokkaido-An application of trench accretion model: Geological Society of Japan Journal, v. 94, p. 817-836.

Taylor, Patrick T., 1983, Magnetic data over the Arctic from aircraft and satellites: Netherlands Cold Regions Science and Technology, v. 7, p. 35-40.

Taylor, S.B., Johnson, S.Y., Fraser, G.T. and Roberts, J.W., 1988, Sedimentation and tectonics of the lower and middle Eocene Swauk Formation in eastern Swauk Bsin, central Cascades, central Washington: Canadian Journal of Earth Science, v. 25, p. 1020-1036

Tennyson, M.E., and Cole, M.R., 1978, Tectonic significance of upper Mesozoic Metrhow-Pasayten sequence, northeastern Cascade Range, Washington and British Columbia, *in* Howell, D.G., and McDougal, K.A., eds., Mesozoic paleogeography of the western United States: Society of Economic Geologists and Mineralogists, Pacific Section, p.499-508.

Terekhov, M.I., 1979, Stratigraphy and tectonics of the southern Omolon massif: Nauka, Moscow, 114 p. (in Russian).

Terekhov, M.I., and Dylevsky, E.F., 1988, Geology of the Arga-Tas Range: U.S.S.R. Academy of Sciences, Magadan, 49 p. (in Russian).

Terekhov, M.I., Lychagin, P.P., and Merzlyakov, V.M., 1984, Geologic map of the Sugoy, Korkodon, Omolon, Oloy and Gijiiga interfluves: U.S.S.R. Ministry of Geology, Magadan, scale 1:500,000, 144 p., (in Russian).

Thorkelson, D.J., and Smith, A.D., 1989, Arc and intraplate volcanism in the Spences Bridge Group: Implications for Cretaceous tectonics in the Canadian Cordillera: Geology, v.17, p. 1093-1096.

Thrupp, G.A., and Coe, R.S., 1986, Early Tertiary paleomagnetic evidence and the displacement of southern Alaska: Geology, v. 14, p. 213-217.

Tibilov, O.V., Milov, A.P., and Davydov, I.A., 1986, Pre-Mesozoic granitoid magmatism in Chukotka: Tikhookeanskaya Geologiya, no. 5, p. 95-98 (in Russian).

Til'man, S.M., 1973, Comparative tectonics of the Mesozoides of the Circum-North Pacific: Nauka, Novosibirsk, 325 p. (in Russian).

Til'man, S.M., Afitsky, A.I., and Chekhov, A.D., 1977, Comparative tectonics of the Alazeya and Oloy zones and the Kolyma massif, northeastern U.S.S.R.: Geotektonika, no. 11, p. 6-17 (in Russian).

Till, A.B., and Dumoulin, J.A., 1994, Geology of Seward Peninsula and Saint Lawrence Island, *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America, v. G1, p. 141-152.

Till, A.B., Schmidt, J.M., and Nelson, S.W., 1988, Thrust involvement of metamorphic rocks, southwestern Brooks Range, Alaska: Geology, v. 10, p. 930-933.

Tipper, H.W., and Richards, T.A., 1976, Jurassic stratigraphy and history of north-central British Columbia: Geological Survey of Canada Bulletin 720, 73 p.

Travers, W.B., 1978, Overturned Nicola and Ashcroft strata and their relation to the Cache Creek Group, southwestern Intermontane Belt, British Columbia: Canadian Journal of Earth Sciences, v. 15, p. 99-109.

Tret'yakov, F.F., 1989, Evolution of tectonic structures in the Kolyma massif: Yakutsk, 140 p. (in Russian).

Tsukanov, N.V., 1991, Tectonic evolution of Kamchatka perioceanic area in the late Mesozoic and early Cenozoic: Nauka, Moscow, 104 p. (in Russian).

Tsukanov, N.V., and .Fedorchuk, A.V., 1989, Oceanic complexes in the structures of the eastern Kumroch area of Kamchatka: Doklady Akademii Nauk SSSR, v. 307, no. 4, p. 943-947 (in Russian).

Tsukanov, N.V., Litvinov, A.F. Fedorchuk, A.B., 1991, The oceanic complex of the Shipunskeiy Peninsula (Eastern Kamchatka): Doklady Akademii Nauk SSSR, v. 318, no. 4, p. 958-962.

Tsukanov, N.V., and Zinkevich, V.P., 1987, Tectonics of the Kumroch Range (eastern Kamchatka): Geotektonika, no. 6, p. 63-77 (in Russian).

Tsvetkov, A.A., Fedorchuyk, A.V., and Gladenkov, A.Yu., 1990, Geologic structure and magmatism of Bering Island: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 7, p. 40-56 (in Russian).

Turner, D.L., Forbes, R.B., Aleinikoff, J.N., Hedge, C.E., and McDougall, I., 1983, Geochronology of the Kilbuck terrane in southwestern Alaska [abs.]: Geological Society of America Abstracts with Programs, v. 15., p. 407.

Turner, D.L., Herreid, Gordon, and Bundtzen, T.K., 1977, Geochronogy of southern Prince of Wales Island: Alaska Division of Geological and Geophysical Surveys Report 55, p. 11-20.

Tynankergav, G.A., and Bychkov, Yu.M., 1987, Siliceous, volcanic, and terrigeneous Upper Triassic deposits of the western Chukotka Peninsula: Doklady Akademii Nauk SSSR, v. 296, p. 698-700 (in Russian).

Tysdal, R.G., and Case, J.E., 1979, Geologic map of the Seward and Blying Sound quadrangles, Alaska: U.S. Geological Survey Miscellaneous Investigations Map I-1150, scale 1:250,000.

Vallier, T.L., 1977, The Permian and Triassic Seven Devils Group, western Idaho and northeastern Oregon: U.S. Geological Survey Bulletin 1437, 58 p.

Vallier, T.L., 1995, Petrology of pre-Tertiary igneous rocks of the Blue Mountains province of Oregon, Idaho, and Washington: Implications for the geologic evolution of a complex island arc, *in* Vallier, T.L., and Brooks, H.C., eds., The geology of the Blue Mountains region of Oregon, Idaho, and Washington: Petrology and tectonic evolution of pre-Tertiary rocks: U.S. Geological Survey Professional Paper 1438, Ch. 3, in press.

Vallier, T.L., Brooks, H.C., and Thayer, T.P., 1977, Paleozoic rocks of eastern Oregon and western Idaho, *in* Stewart, J.H., Stevens, C.H., and Fritsche, A.E., eds., Paleozoic paleogeography of the western United States (Pacific Coast Paleogeography Symposium 1): Los Angeles, Society of Economic Paleontologists and Mineralogists, Pacific Section, p. 455-466.

Vallier, T.L., Scholl, D.W., Fisher, M.A., Bruins, T.R., Wilson, F.H., von Huene, R., and Stevenson, A.J., 1994, Geologic framework of the Aleutian arc, Alaska, , *in* Plafker, G. and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America: The Geology of North America,v. G1, p. 367-388.

van der Heyden, P., 1992, A Middle Jurassic to early Tertiary Andean-Sierran arc model for the Coast Belt of British Columbia: Tectonics, v.11, p. 82-97.

Van der Voo, R., 1993, Paleomagnetics of the Atlantic, Tethys and Iapetus Oceans: Cambridge University Press, Cambridge, 411 p.

Van der Voo, R., Jones, D.L., Gromme, C.S., Eberlein, G.D. and Churkin, M., 1980, Paleozoic paleomagnetism and northward drift of the Alexander terrane, southeastern Alaska: Journal of Geophysical Research, v. 85, p. 5,281-5,296.

Van Wagoner, N.A., Williamson, M.C., Robinson, P.T., and Gibson, I.L., 1986, First samples of acoustic basement recovered from the Alpha Ridge, Arctic Ocean: New constraints for the origin of the ridge: Journal of Geodynamics, v, 6, p. 177-196.

Vance, J.A., Clayton, G.A., Mattinson, J.M., and Naeser, C.W., 1987, Early and middle Cenozoic stratigraphy of the Mount Rainier-Tieton River area, southern Washington Cascades, *in* Schuster, J.E., ed., Selected Papers on the Geology of Washington: Wasington Division of Geology and Earth Resources Bulletin 77, p. 269-290.

Vance, J.A., Dungan, M.A., Blanchard, D.P. and Rhodes, J.M., 1980, Tectonic setting and trace element geochemistry of Mesozoic ophiolitic rocks in western Washington: American Journal of Science, v. 280-A, p. 359-388.

Vandall, T.C., and Palmer, H.C., 1990, Canadian Cordilleran displacement: paleomagnetic results from the Early Jurassic Haželton Group, Terrane I, British Columbia, Canada: International Geophysical Journal, v. 103, p. 609-620.

Vasiliyev, B.I., Putintsev, V.K., and Rublyov, A.G., 1984, Radiometric age of intrusive rocks on submarine rises, Sea of Okhotsk: Doklady Akademii Nauk SSSR, v. 278, v. 6, p. 1426-1429. (in Russian).

Vasiliyev, B.I., Zhiltsov, E.G., and Suvorov, A.A., 1979, Geologic structure of the southwestern part of the Kuril arc-trench system: Nauka, Moscow, 105 p. (in Russian)

Vel'dynaksov, F.F., and Umitbaev, R.B., 1976, Tectonics and metallogeny outlines of the Okhotsk massif and adjacent areas: Folded systems of Far East: U.S.S.R. Academy of Sciences, Vladiovstok, p. 93-117 (in Russian).

Verzkhovskaya, V.A., and Krichevets, V.I., 1987, Geologic map of the U.S.S.R.: U.S.S.R. Ministry of Geology, Leningrad, scale, 1:1,000,000 (in Russian).

Vinogradov, V.A., 1984, Laptev Sea, *in* Gramberg, I. S., and Pogrebitsky, Y. E., eds., Geologic structure of the U.S.S.R. and characteristics in the distribution of mineral resources, v. 9, Seas of the Soviet Arctic: Nedra, Leningrad, p. 50- 60 (in Russian).

Vinogradov, V.A., Gaponenko, G.I., Gramberg, I.S., and Shimaraev, V.N., 1976, Structural-associational complexes of the Arctic Shelf of eastern Sibera: Sovetskaya Geologiya, no. 9, p. 23-28.

Vinogradov, V.A., Gaponenko, G.I., Rusakov, I.M., and Shimaraev, V.N., 1974, Tectonics of the eastern Arctic Shelf of the U.S.S.R.: Nedra, Leningrad, 144 p. (in Russian).

Vinogradov, V. A., Kogan, A. L., and Shimaraev, V. N., 1992, Results of regional seismic investigations in the southeastern part of the Laptev Sea: Geologiya i Geofizika, no. 6, p. 113-118 (in Russian).

Vishnevskaya, V.S., Filatova, N.I., and Dvoryankin, A.I., 1991, New data on Jurassic deposits of Semiglavaya Mountain: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, no. 4, p. 21-30.

Vinogradov, V.A., Kameneva, G.I., and Yavshits, G.P., 1975, On the Hyperborean platform in the light of new data on the geologic structure of Henrietta Island: Arctic Tectonics, v. 1, p. 21-25 (in Russian).

Vishnevskaya, V.S., Peyve, A.A., Sokolov, S.D., 1992, Age of the Kuyul ophiolite terrane of northeastern Russian: Doklady Akademii Nauk SSSR, Moscow, v. 327, p. 364-367 (in Russian).

Vlasov, G.M., ed., 1964, Kamchatka, Kuril, and Komandorsky islands, part 1, Geologic descriptions, *in* Geology of the U.S.S.R.: Nedra, Moscow, v. 31, 733 p (in Russian).

Vlasov, G.M., ed., 1977, Kamchatka, Kuril, and Komondorsky Islands mineral deposits: in Geology of the U.S.S.R.: Nedra, Moscow, v. 31, 351 p. (in Russian).

Voevodin, V.N., Zhitkov, N.G., and Solov'ev, V.A., 1978, Mesozoic eugeosynclinal complex of Chukotsk Peninsula: Geotektonika, no. 6, p. 101-109 (in Russian).

Vol'nov, D.A., Volitsekhovsky, V.N., Ivanov, O.A., Sorokov, D.S., and Yashin, D.S., 1970, New Siberian Islands, *in* Tkachenko, B.V., and Egiazarov, B.K., eds., Geology of the U.S.S.R., v. 26, Islands of the Soviet Arctic: Nedra, Moscow, p. 324-374.

Volcanic belts of eastern Asia, 1984: Nauka, Moscow, p. 123-134 (in Russian).

Volk V.E., and Gaponenko G.I., 1981, Geology of the Earth crust of the Arctic shelf of the U.S.S.R., *in* Marine Geophysical Investigations in the Arctic: U.S.S.R. Academy of Sciences, Leningrad, p. 16-27 (in Russian).

Volk, V. E., and Gaponenko, G. I., 1984, Analysis of physical fields and deep structure of the earth's crust, *in* Gramberg, I. S., and Pogrebitsky, Y. E., eds., Geologic structure of the U.S.S.R. and characteristics of the distribution of mineral resources, seas of the Soviet Arctic: Nedra, Leningrad, v. 9, p. 98-107 (in Russian).

Volk V.E., Gaponenko G.I., and Karasik A.M., 1984, Geologic profiles of the Earth's crust of Arctic shelf of the U.S.S.R., *in* Geologic composition of the U.S.S.R. and characteristics of the distribution of mineral resources, seas of Soviet Arctic: Nedra, Leningrad, v. 9, p. 102 (in Russian).

Vol'nov, D.A., 1975, History of the geologic development of the New Siberian Islands region, *in* Geology and mineral resources of the New Siberian Islands and Wrangel Island: Geological Institute of the Arctic, Leningrad, p. 61-71 (in Russian).

Vol'nov, D.A., Voitsekhovskii, V.N., Ivanov, O.A., Sorokov, D.S., and Yashin, D.S., 1970, New Siberian Islands, *in* Tkachenko, B.V., and Egiazarov, B.K., eds., Geology of the U.S.S.R., Islands of the Soviet Arctic: Nedra, Moscow, v. 26, p. 324-374 (in Russian).

Volobueva, V.I., and Krasnyi, L.L., 1979, Maastrichtian-Neogene deposits of the eastern Koryak Highland: Nauka, Moscow, 83 p. (in Russian).

Volsky, A.S., 1983, Geologic structure and history of the Upper Primorye: Summary of Ph.D. thesis, VSEGEI, Ministry of Geology, Leningrad, 25 p. (in Russian).

Volynets, O.N., Antipin, V.S., Perepelov, A.B., and Anoshin, A.B., 1990, Geochemistry of the volcanic series of an island-arc system in terms of geodynamics for Kamchatka: Geologiya i Geofizika, no. 5, p. 3-13 (in Russian).

Vrublevsky, A.A., Melnikov, N.G., Golozubov, V.V., and others, 1988, Mixtites of the Sikhote-Alin Fold Belt: Far Eastern Branch, U.S.S.R. Academy of Sciences, Vladivostok, 3 p. (in Russian).

Walker, G.W. and MacLeod, N.S., 1991, Geologic Map of Oregon: U.S. Geological Survey, 2 sheets, scale 1:500,000.

Wallace, W.K., Hanks, C.L., and Rogers, J.F., 1989, The southern Kahiltna terrane: Implications for the tectonic evolution of southwestern Alaska: Geological Society of America Bulletin, v. 101, p. 1389-1407.

Walsh, T.J., Korosec, M.A., Phillips, W.M., Logan, R.L., and Schasse, H.W., 1987, Geologic map of Washington--southwest quadrant: Washington Division of Geology and Earth Resources, Olympia, Washington, scale 1:250,000.

Watanabe, T., 1981, Idonnappu Formation in the Kamuikotan Belt as constituent of a Mesozoic subduction wedge, *in* Hara, I., ed., Tectonics of paired metamorphic belt: Tanishi, Hiroshima, p. 37-41.

Watson, F.F., and Fujita, Kazuya, 1985, Tectonic evolution of Kamchatka and the Sea of Okhotsk and implications for the Pacific Basin, *in* Howell, D.G., ed., Tectonostratigraphic terranes of the Circum-Pacific Region: Circum-Pacific Council for Energy and Mineral Resources, Earth Science Series, v. 1, p. 333.-348.

Weber, F.R., McCammon, R.B., Rinehart, C.D., Light, T.D., and Wheeler, K.L., 1988, Geology and mineral resources of the White Mountains National Recreation area, east-central Alaska:U.S. Geological Survey Open-File Report 88-284, 234 p., 23 plates.

Weber, F.R., Smith, T.E., Hall, M.H., and Forbes, R.B., 1985, Geologic guide to the Fairbanks-Livengood area, east-central Alaska:Alaska Geological Society, Anchorage, Alaska, 45 p.

Weber, F.R., Wheeler, K.L., Rinehart, C.D., Chapman, R.M., and Blodgett, R.B., 1992, Geologic map of the Livengood quadrangle, Alaska: U.S. Geological Survey Open-File Report 92-562, 1 sheet, scale 1:250,000, 20 p.

Weber, J.R., 1986, The Alpha Ridge: Gravity, seismic, and magnetic evidence for a homogenous, mafic crust: Journal of Geodynamics, v. 6, p. 117-136.

Weber, J.R., and Sweeney, J.F., 1990, Ridges and basins in the central Arctic Ocean, *in* Grantz, Arthur, Johnson, G.L., and Sweeney, J.F., eds., The Arctic Ocean Region: Geological Society of America, Geology of North America, v. L, p. 305-336.

Wells, R.E., Engebretson, D.C., Snavely, P.D., Jr. and Coe, R.S., 1984, Cenozoic plate motions and the volcano-tectonic evoution of western Oregon and Washington: Tectonics, v. 3, p. 275-294.

Wells, R.E., Simpson, R.W., Bentley, R.D., Beeson, M.H., Mangan, M.T. and Wright, T.L., 1989, Correlation of Miocene flows of the Columbia River Basalt Group from the central Columbia River Plateau to the coast of Oregon and Washington, *in* S. P. Reidel and P. R. Hooper, eds., Volcanism and tectonism in the Columbia River flood-basalt province: Geological Society of America, Bulletin, v. 239, p. 113-128.

Wernicke, B., and Klepacki, D.W., 1988, Escape hypothesis for the Stikine block: Geology, v. 16, p. 461-464.

Wheeler, J.O., Brookfield, A.J., Gabrielse, H., Monger, J.W.H., Tipper, H.W., and Woodsworth, G.J., 1988, Terrane map of the Canadian Cordillera: Geological Survey of Canada Open File Report 1894, scale 1:2,000,000, 9 p.

Wheeler, J.O., and McFeeley, P., 1991, Tectonic assemblage map of the Canadian Cordillera and adjacent parts of the United States of America: Geological Survey of Canada Map 1712A, 3 sheets, scale 1:2,000,000.

Whetten, J.T., Carroll, P.I., Gower, H.D., Brown, E.H. and Pessl, F., Jr., 1988, Bedrock geologic map of the Port Townsend quadrangle, Washington: U. S. Geological Survey Miscellaneous Investigations Map I-1198-G, scale 1:100,000.

Whetten, J.T., Zartman, R.E., Blakely, R.J., and Jones, D.L., 1980, Allochthonous Jurassic ophiolite in northwest Washington: Geological Society of America Bulletin, v. 91, p. 1359-1368.

Wittbrodt, P.R., Stone, D.B. and Turner, D.L., 1989, Paleomagnetism and geochronology of St. Matthew Island, Bering Sea: Canadian Journal of Earth Sciences, v. 26, p. 2116-2129.

Wilson, Douglas, and Cox, Allan, 1980, Paleomagnetic evidence for tectonic rotation of Jurassic plutons in Blue Mountains, eastern Oregon: Journal of Geophysical Research, v. 85, p. 3681-3689.

Wilson, F.H., Detterman, R.L., and DuBois, G.D., in press, Geologic framework of the Alaska Peninsula, southwest Alaska, and the Alaska Peninsula terrane: U.S. Geological Survey Bulletin 1969-B, 2 sheets scale 1:500,000, __ p.

Wilson, J.T., 1963, Hypothesis of the Earth's behavior: Nature, v. 198, p. 925-929.

Winterer, E.L., 1991, Sediment thickness map of the northeast Pacific, *in* Winterer, E.L., Hussong, D.M., and Decker, R.W., eds., The eastern Pacific Ocean and Hawaii: Geological Society of America, Geology of North American, v. N, p. 307-310.

Wirth, K.R., Harding, D.J., Blythe, A.E., and Bird, J.M., 1986, Brooks Range ophiolite crystallization and emplacement ages from $^{40}Ar/^{39}Ar$ data [abs.]: Geological Society of America Abstracts with Programs, v. 18, p. 792.

Witte, W.L, Stone, D.B. and Mull, G.C., 1987, Paleomagnetism, paleobotany and paleogeography of the Cretaceous arctic slopes, *in* Tailleur, I., Weimer, P., eds., Alaskan North Slope Geology: Society of Economic Paleontologists and Mineralogists, v. 2, p. 771-780.

Woodsworth, G.J., Anderson, R.G., and Armstrong, R.L., 1992, Plutonic regimes, *in* Gabrielse, H., and Yorath, C.J., eds., Geology of the Cordilleran Orogen in Canada: Boulder, Colorado, Geological Society of America, The Geology of North America, v. G-2, p.493-631.

Worall, D.M., 1991, Tectonic history of the Bering Sea and the evolution of Tertiary strike-slip basins of the Bering Shelf: Geological Society of America Special Paper 257, 120 p., 3 sheets, scale 1:2,500,000.

Yagi, K., 1969, Petrology of the alkaline dolerites of the Nemuro Peninsula, Japan, Geological Society of America Memoir 115, p. 103-147.

Yole, R.W., 1969, Upper Paleozoic stratigraphy of Vancouver Island: Geological Association of Canada Proceedings, v. 20, p. 30-40.

Yoshida, T., and Aoki, C., 1972, Paleozoic formation in the Matsumae Peninsula, Hokkaido, and the occurrence of conodonts from the southern part of the Oshima Peninsula, Hokkaido, Japan: Geological Survey of Japan Bulletin, v. 23, p. 635-646 (in Japanese with English abstract).

Yurkova R.M., 1991, Mineral alterations of ophiolitic and hosting volcano-sedimentary units of the northwestern Pacific margin: Nauka, Moscow, 164 p. (in Russian).

Yushmanov, Yu.P., 1986, Synsedimentary tectonic nappes of the East Sikhote-Alin Pribrezhnay zone in the Dalnegorsk ore region: Tikhookeanskaya Geologiya, v. 3, p. 99-107.

Zablotsky, E.M., Kalachova, E.D., Okuneva, T.M., Sei, I.I., and Tikhomirova, L.B., 1990, New data on stratigraphy of Triassic and Jurassic deposits of the Gorinsk synclinorium [abs.], *in* Precambrian and Phanerzoic stratigraphy of the Transbaikal region and the southern Far East: Abstracts of the 14th Far East Regional Interdepartment Stratigraphic Meeting, U.S.S.R. Academy of Sciences, Khabarovsk, p. 148-151 (in Russian).

Zaborovskaya, N.B., 1978, Inner zone of the Okhotsk-Chukotka belt on Taigonos Peninsula: Nauka, Moscow, 199 p. (in Russian).

Zagruzina, I.A., 1977, Geochronology of Mesozoic granitoids in the northeastern U.S.S.R.: Moscow, Nauka, 279 p. (in Russian).

Zen, E-an, 1985, Implications of magmatic-epidote plutons on crustal evolution of the accreted terranes of northwestern North America: Geology, v. 13, p. 266-269.

Zhizhina, M.S., 1959, Age of Paleozoic deposits on Kotel'nyi Island: Izvestiya Akademii Nauk SSR, Seriya Geologicheskaya, v. no, p. 90-91 (in Russian).

Zhulanova, I.L., 1990, The Earth's crust of northeastern Asia in the Precambrian and Phanerozoic: Nauka, Moscow, 304 p. (in Russian).

Zhulanova, I.L., and Pertzev, A.N., 1987, Basalt of the northern part of the Pekul'ney Ridge: Geology, petrologic characteristics, and problems of genesis: Tikhookeanskaya Geologiya, no. 3, p. 65-76 (in Russian).

Zhuravlyov, A.V., 1984, Comparative characteristics of the Deryugin and Tinro basins, Sea of Okhotsk: Tikhookeanskaya Geologiya, no. 1, p. 21-27 (in Russian).

Zinkevich, V.P., 1981, Formations and stages of tectonic development of the northern Koryak Highland: Nauka, Moscow, 108 p. (in Russian).

Zinkevich, V.P., Kazimirov, A.D., Peive, A.A., and Churakov, G.M., 1985, New data on the tectonic structure of Cape Kamchatka, eastern Kamchatka: Doklady Akademii Nauk SSSR, v. 285, p. 954-957 (in Russian).

Zinkevich, V.P., Konstantinovskaya, E.A., Magakyan, P., and Bragina, L.G., 1988, Tectonics of the Ozernoi Peninsula (eastern Kamchatka), *in* Essays on the geology of Kamchatka and the Koryak Highland: Nauka, Moscow, p. 87-102 (in Russian).

Zinkevich, V.P., Konstantinovskaya, E.A., Magakyan, R.G., and Tsukanov, N.V., 1990, Accretionary structure of eastern Kamchatka: Doklady Akademii Nauk SSSR, v. 312, no. 5, p. 1186-1190 (in Russian).

Zinkevich. V.P., Konstantinovskaya, E.A., and Tsukanov, N.V., 1989, Tectonic nappes of the northern part of the Valaginskiy Range: Tikhookeanskaya Geologiya, no. 8, p. 62-71 (in Russian).

Zinkevich. V.P., and Tsukanov, N.V., 1993, Accretionary tectonics of Kamchatka: International Geology Review, v. 35, p. 953-973.

Zinkevich. V.P., Konstantinovskaya, E.A., Tsukanov, N.V., 1989, and Rikhter, A.V., 1993, Accretionary tectonics of Eastern Kamchatka: Nauka, Moscow, 272 p. (in Russian).

Zmievskiy, Yu. P., Petukhov, A.D., and Kir'yanova, V.V., 1990, New data on the structure and age of the Dzhelon suite, *in* Stratigraphy of the Precambrian and Phanerozoic in Transbaikal'e and the southern Far East: U.S.S.R. Academy of Sciences, Khabarovsk, p. 179-180 (in Russian).

Zmievsky, Yu.P., 1988, The Anyui prominence and complexes of Mesozoic basement in Primorye: Summary of Ph.D. Thesis, U.S.S.R. Academy of Sciences, Khabarovsk, 26 p. (in Russian).

Zonenshain, L.P., Kuzmin, M.I., and Natapov, L.M., 1990, Tectonics of the lithospheric plates of the U.S.S.R. territory: Nedra, Moscow, v. 1, 328 p, v. 2, 334 p (in Russian).

Zonenshain, L.P. and Natapov, L.M., 1987, Tectonic history of the Arctic, *in* Present-day problems of ocean and continent tectonics: Nauka, Moscow, 31-56 (in Russian).

Zyabrev S.V., 1984. Upper Mesozoic turbidites of the southern West Sakhalin trough: Tikhookeanskaya Geologiya, no. 5, p. 22-33 (in Russian).

EXPLANATION FOR STRATIGRAPHIC COLUMNS

- NONMARINE CLASTIC DEPOSITS
- SHALLOW-MARINE TERRIGENOUS DEPOSITS
- SHALLOW-MARINE CARBONATE DEPOSITS
- SHALLOW-MARINE SILICEOUS DEPOSITS
- DEEP-MARINE HEMIPELAGIC SEDIMENTARY AND VOLCANIC DEPOSITS
- DEEP-MARINE PELAGIC AND SILICEOUS DEPOSITS
- OCEANIC CRUST, SEAMOUNTS, AND OPHIOLITES
- MAFIC VOLCANIC AND VOLCANICLASTIC ROCKS
- TURBIDITE DEPOSITS
- RIFT-RELATED GRANITIC ROCKS
- ANATECTIC GRANITIC ROCKS
- SUBDUCTION-RELATED MAFIC AND ULTRAMAFIC PLUTONIC ROCKS
- RIFT-RELATED MAFIC AND ULTRAMAFIC PLUTONIC ROCKS
- SUBDUCTION-RELATED VOLCANIC AND SEDIMENTARY ROCKS
- RIFT-RELATED VOLCANIC AND SEDIMENTARY ROCKS
- SUBDUCTION-RELATED GRANITIC ROCKS
- PROTEROZOIC OR ARCHEAN CRATONAL BASEMENT
- INTENSELY METAMORPHOSED AND DEFORMED ROCKS OF INDETERMINATE ORIGIN
- STRATIGRAPHIC HIATUS

TECTONIC OVERPRINTS:

- SUBDUCTION ZONE OR ACCRETIONARY COMPLEX
- TECTONIC MELANGE
- PENETRATIVELY DEFORMED OR REGIONALLY METAMORPHOSED
- OLISTOSTROMAL DEPOSITS
- B BLUESCHIST-FACIES METAMORPHISM

CONTACTS:

- STRATIGRAPHIC OR INTRUSIVE CONTACT
- TIME-TRANSGRESSIVE CONTACT
- CONTACT BETWEEN FACIES
- MAJOR UNCONFORMITY
- FAULT
- TIME SPAN OF TERRANE

ISOTOPIC SYMBOLS:

- K, K - Ar
- Ar, Ar - Ar
- R, Rb - Sr
- U, U - Pb
- S, Sm-Nd

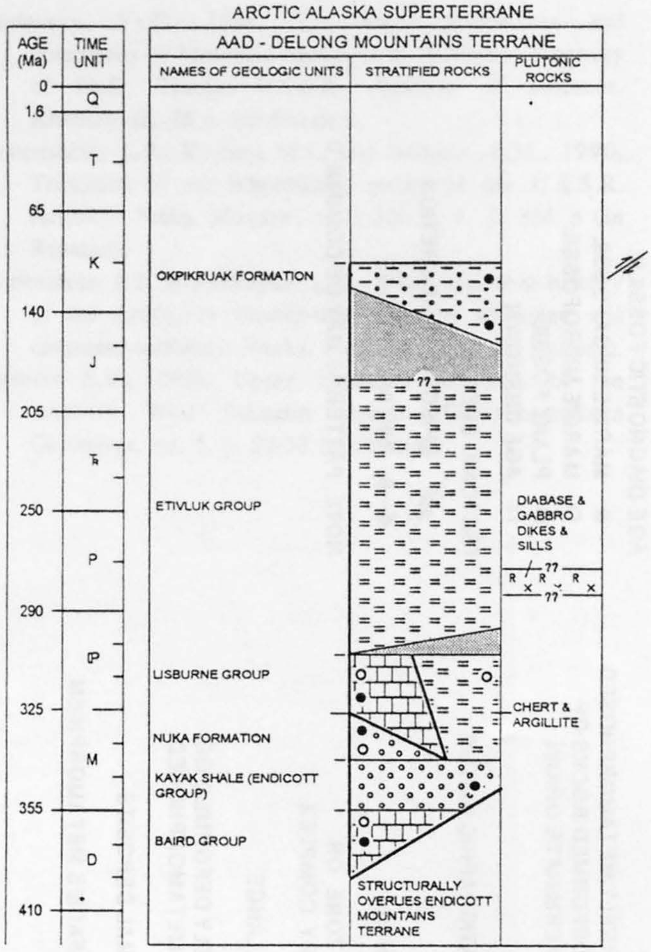
AGE DIAGNOSTIC FOSSILS:

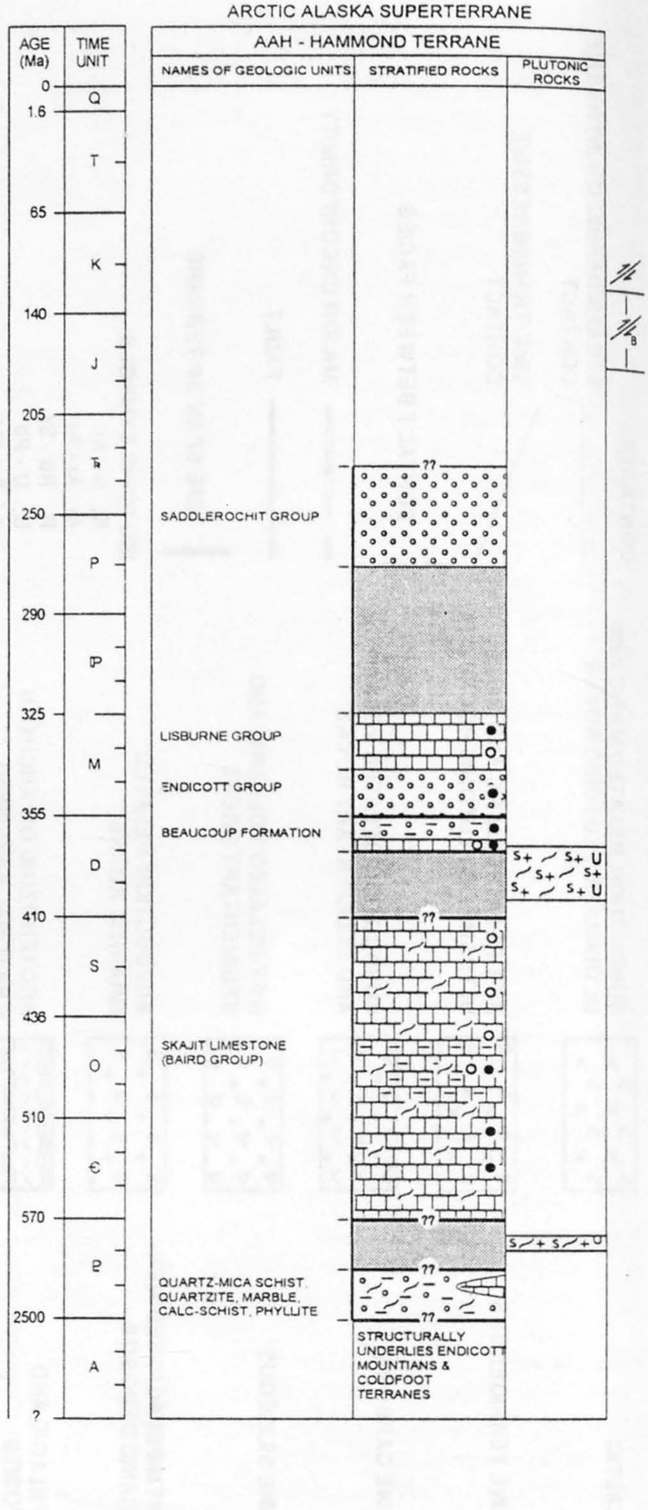
- ● MARINE MEGAFOSSIL
- O MARINE MICROFOSSIL
- ■ PLANT FOSSIL
- ?? AGE UNKNOWN

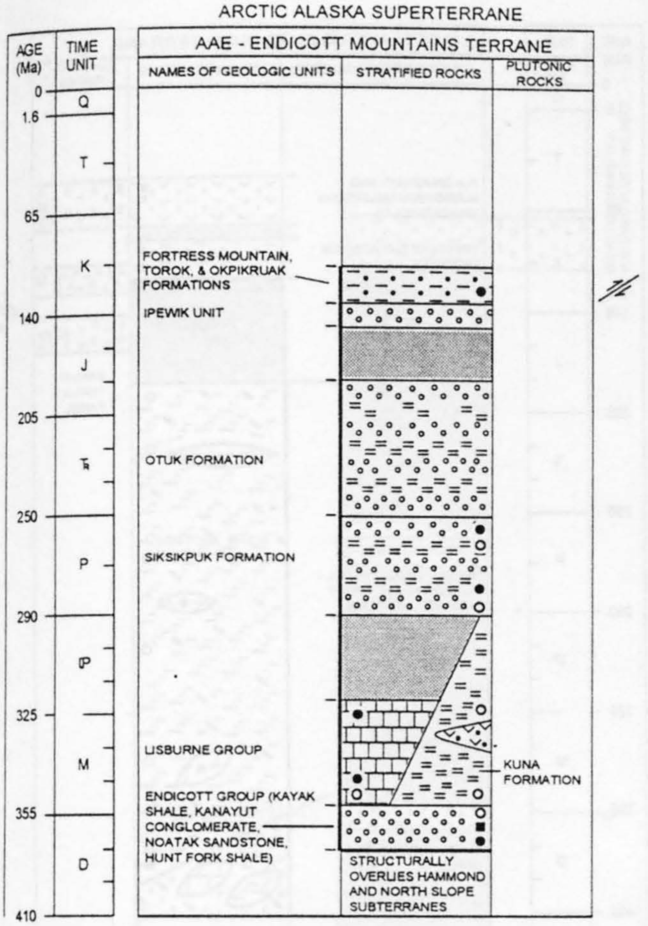
TECTONIC EVENTS:

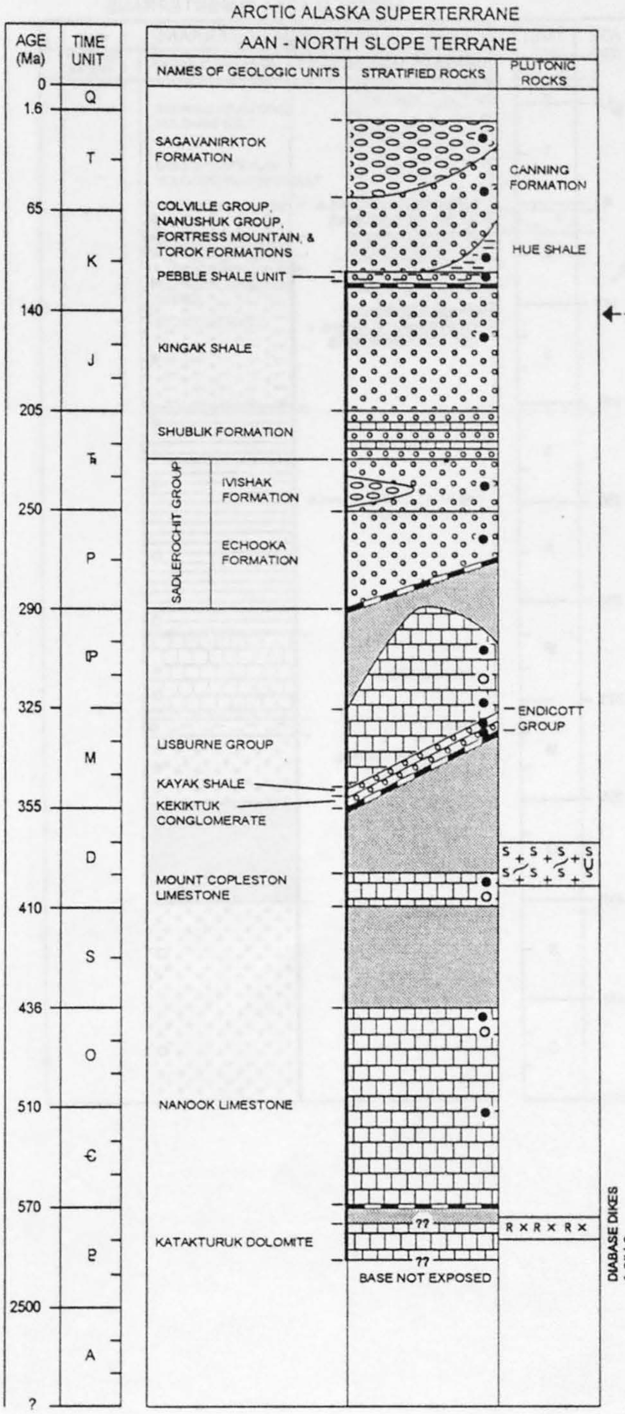
- EPISODE OF ACCRETION
- RIFTING EPISODE

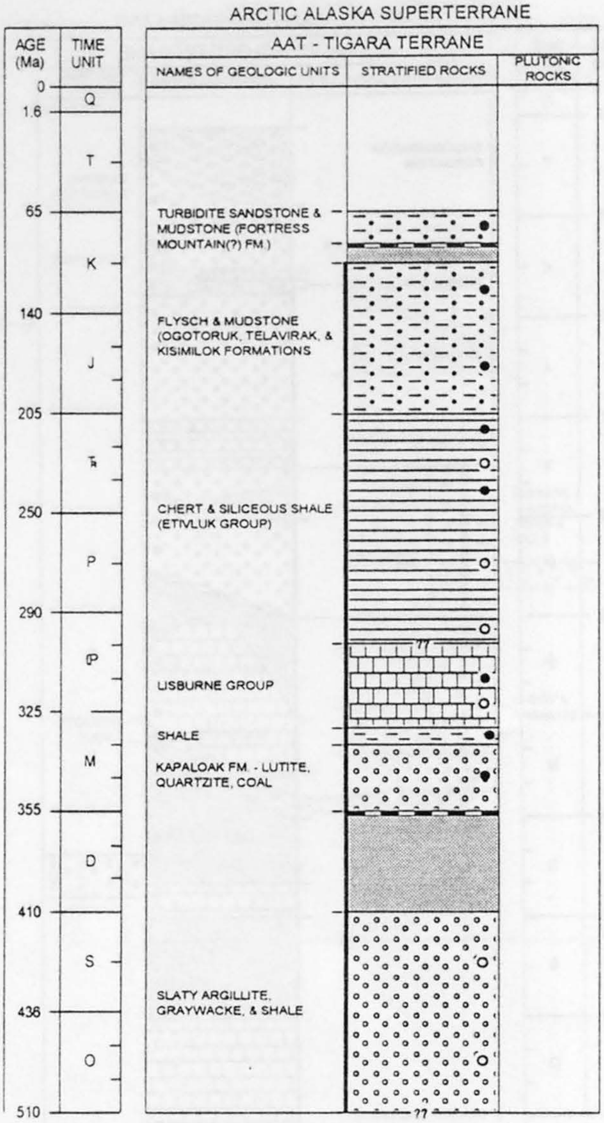
NOTE: PATTERNS MAY BE COMBINED


ARCTIC ALASKA SUPERTERRANE
AAD - DELONG MOUNTAINS TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
Ћ
P
IP
M
D
OKPIKRUAK FORMATION
ETIVLUK GROUP
LISBURNE GROUP
NUKA FORMATION
KAYAK SHALE (ENDICOTT GROUP)
BAIRD GROUP
DIABASE & GABBRO DIKES & SILLS
CHERT & ARGILLITE
STRUCTURALLY OVERLIES ENDICOTT MOUNTAINS TERRANE

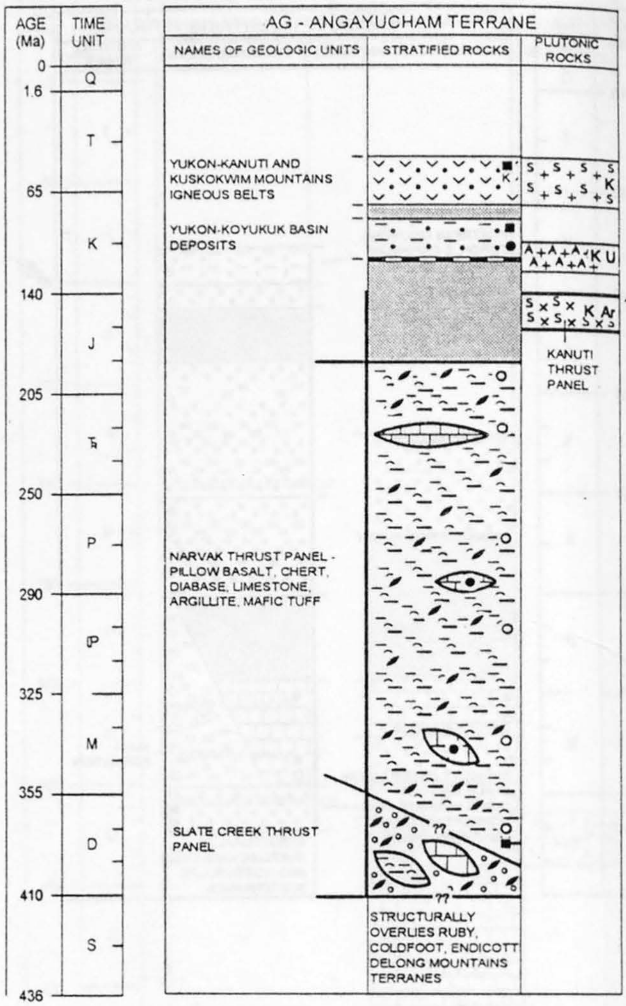

ARCTIC ALASKA SUPERTERRANE
AAH - HAMMOND TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
Ћ
P
IP
M
D
S
O
Є
P
A
SADDLEROCHIT GROUP
LISBURNE GROUP
ENDICOTT GROUP
BEAUCOUP FORMATION
SKAJIT LIMESTONE (BAIRD GROUP)
QUARTZ-MICA SCHIST, QUARTZITE, MARBLE, CALC-SCHIST, PHYLLITE
STRUCTURALLY UNDERLIES ENDICOTT MOUNTIANS & COLDFOOT TERRANES


ARCTIC ALASKA SUPERTERRANE
AGE (Ma)
TIME UNIT
AAE - ENDICOTT MOUNTAINS TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
Ћ
250
P
290
IP
325
M
355
D
410
FORTRESS MOUNTAIN, TOROK, & OKPIKRUAK FORMATIONS
IPEWIK UNIT
OTUK FORMATION
SIKSIKPUK FORMATION
LISBURNE GROUP
KUNA FORMATION
ENDICOTT GROUP (KAYAK SHALE, KANAYUT CONGLOMERATE, NOATAK SANDSTONE, HUNT FORK SHALE)
STRUCTURALLY OVERLIES HAMMOND AND NORTH SLOPE SUBTERRANES

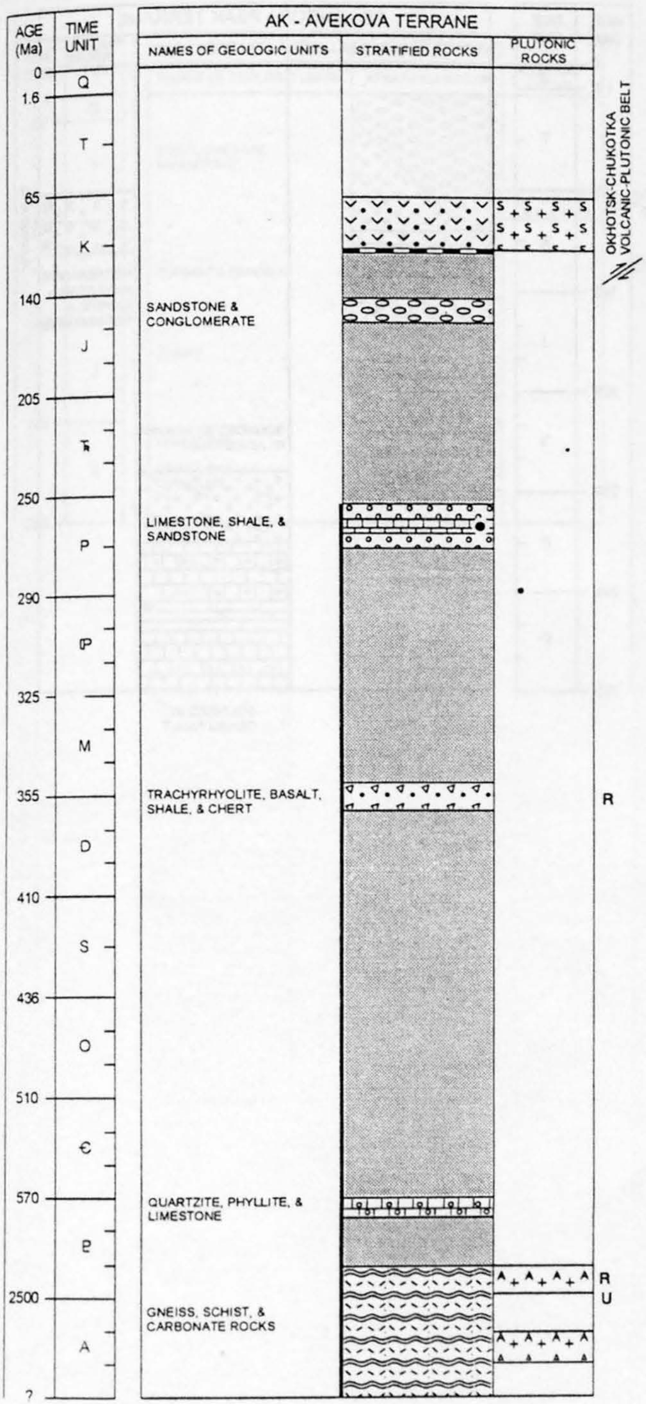

ARCTIC ALASKA SUPERTERRANE
AGE (Ma)
TIME UNIT
AAN - NORTH SLOPE TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
Ћ
250
P
290
IP
325
M
355
D
410
S
436
O
510
Є
570
Ꞓ
2500
A
?
SAGAVANIRKTOK FORMATION
CANNING FORMATION
COLVILLE GROUP, NANUSHUK GROUP, FORTRESS MOUNTAIN, & TOROK FORMATIONS
HUE SHALE
PEBBLE SHALE UNIT
KINGAK SHALE
SHUBLIK FORMATION
SADLEROCHIT GROUP
IVISHAK FORMATION
ECHOOKA FORMATION
ENDICOTT GROUP
LISBURNE GROUP
KAYAK SHALE
KEKIKTUK CONGLOMERATE
MOUNT COPLESTON LIMESTONE
NANOOK LIMESTONE
KATAKTURUK DOLOMITE
BASE NOT EXPOSED
DIABASE DIKES & SILLS

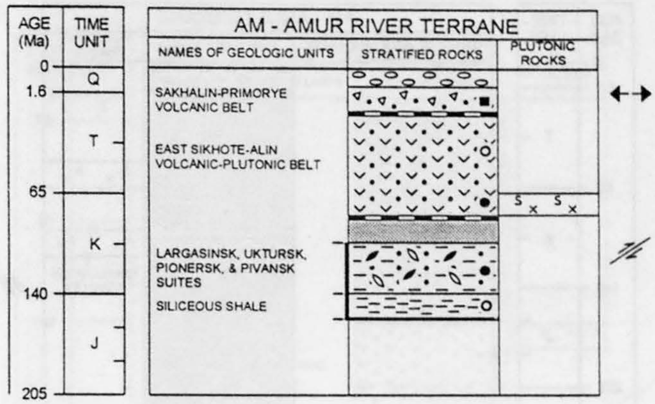


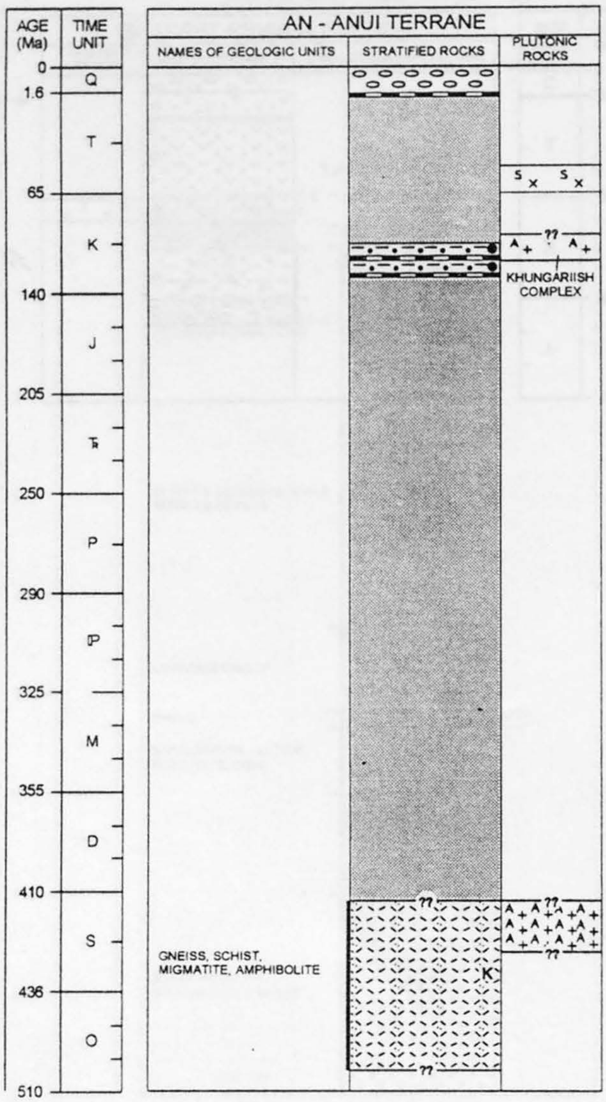
ARCTIC ALASKA SUPERTERRANE
AAT - TIGARA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
Q
T
K
J
Ћ
P
ℙ
M
D
S
O
TURBIDITE SANDSTONE & MUDSTONE (FORTRESS MOUNTAIN(?) FM.)
FLYSCH & MUDSTONE (OGOTORUK, TELAVIRAK, & KISIMILOK FORMATIONS
CHERT & SILICEOUS SHALE (ETIVLUK GROUP)
LISBURNE GROUP
SHALE
KAPALOAK FM. - LUTITE, QUARTZITE, COAL
SLATY ARGILLITE, GRAYWACKE, & SHALE
??

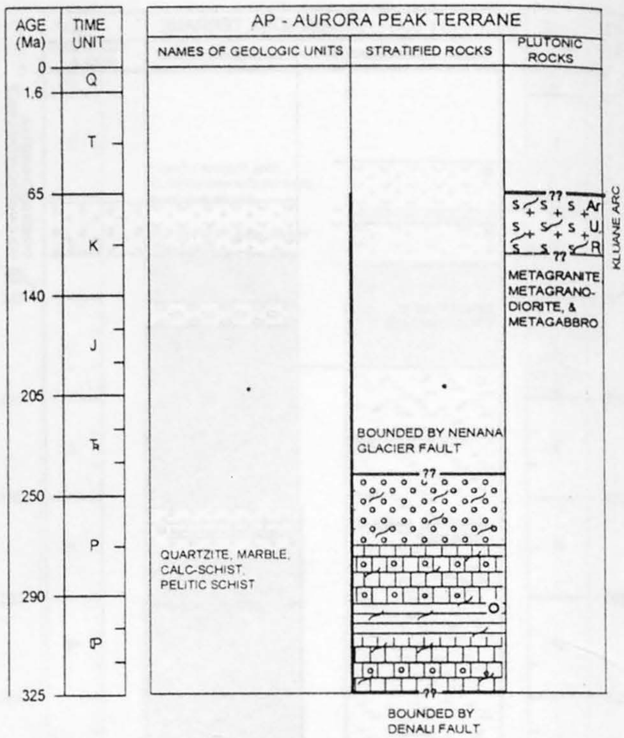


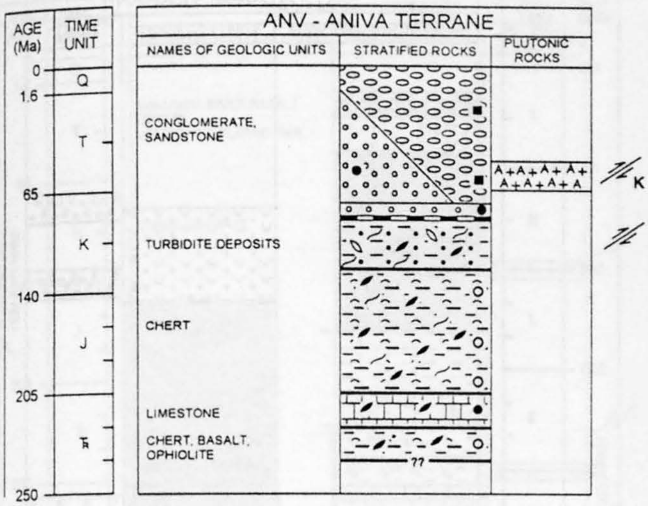
AG - ANGAYUCHAM TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
Q
T
K
J
Ћ
P
ℙ
M
D
S
YUKON-KANUTI AND KUSKOKWIM MOUNTAINS IGNEOUS BELTS
YUKON-KOYUKUK BASIN DEPOSITS
NARVAK THRUST PANEL - PILLOW BASALT, CHERT, DIABASE, LIMESTONE, ARGILLITE, MAFIC TUFF
SLATE CREEK THRUST PANEL
STRUCTURALLY OVERLIES RUBY, COLDFOOT, ENDICOTT DELONG MOUNTAINS TERRANES
KANUTI THRUST PANEL
K
KU
KAr
??

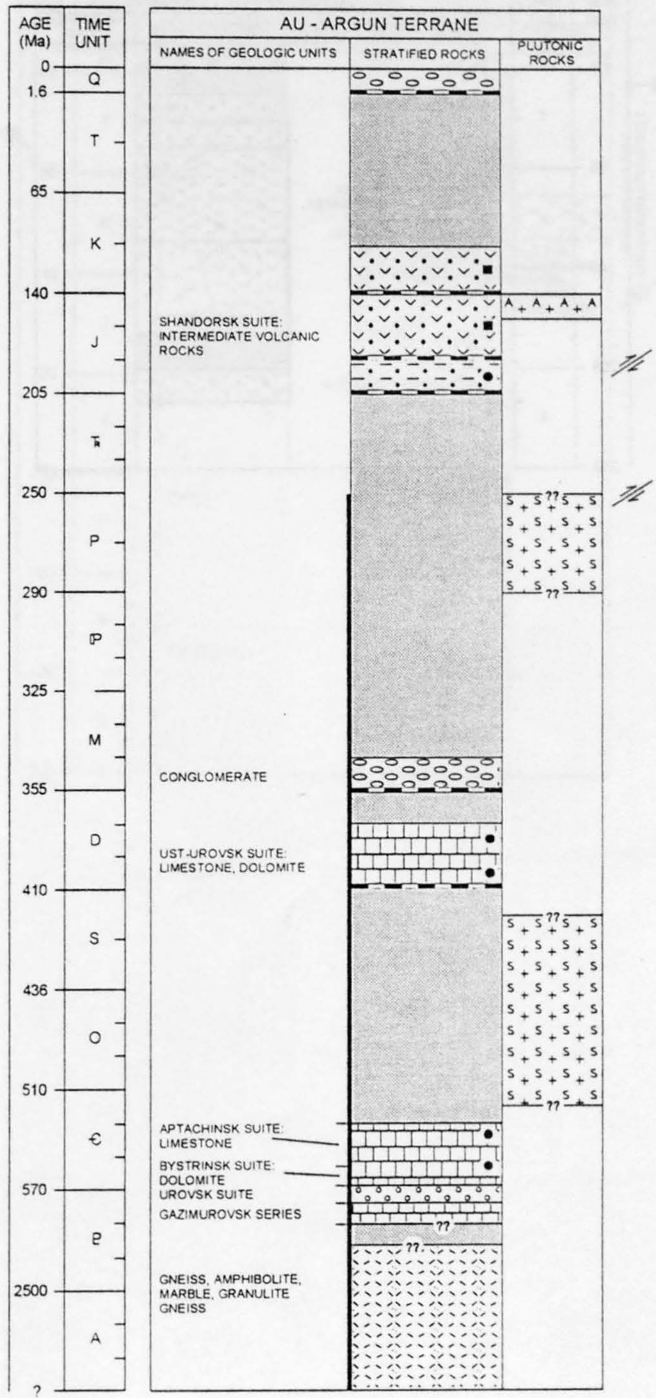

AK - AVEKOVA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
Q
1.6
T
65
K
140
J
205
Ћ
250
P
290
₽
325
M
355
D
410
S
436
O
510
Є
570
Ꞓ
2500
A
?
SANDSTONE & CONGLOMERATE
LIMESTONE, SHALE, & SANDSTONE
TRACHYRHYOLITE, BASALT, SHALE, & CHERT
QUARTZITE, PHYLLITE, & LIMESTONE
GNEISS, SCHIST, & CARBONATE ROCKS
OKHOTSK-CHUKOTKA VOLCANIC-PLUTONIC BELT
R
R
U

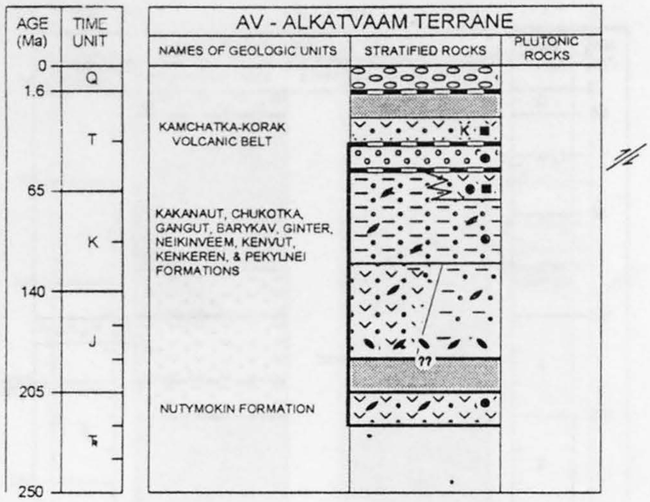

AM - AMUR RIVER TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
Q
1.6
T
65
K
140
J
205
SAKHALIN-PRIMORYE VOLCANIC BELT
EAST SIKHOTE-ALIN VOLCANIC-PLUTONIC BELT
LARGASINSK, UKTURSK, PIONERSK, & PIVANSK SUITES
SILICEOUS SHALE

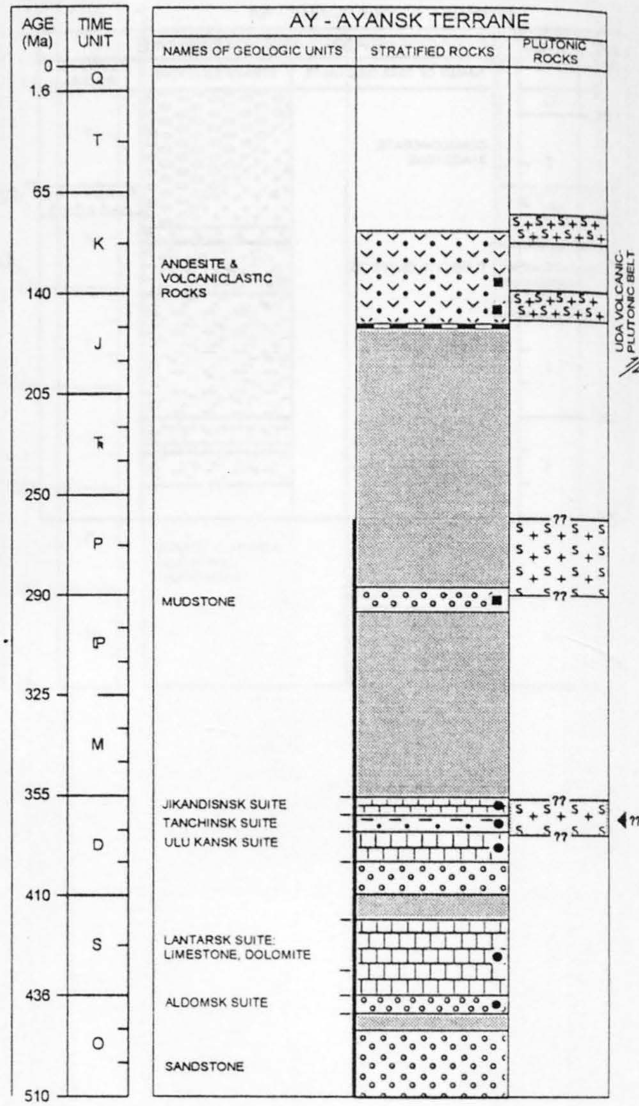

AGE (Ma)
TIME UNIT
AN - ANUI TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
Q
T
K
J
Ћ
P
ᴾ
M
D
S
O
KHUNGARIISH COMPLEX
GNEISS, SCHIST, MIGMATITE, AMPHIBOLITE

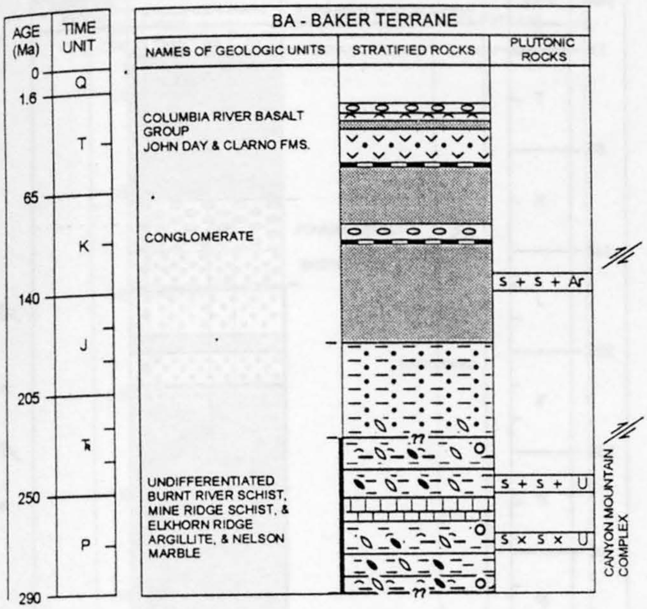

AGE (Ma)
TIME UNIT
AP - AURORA PEAK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
Q
T
K
J
Ћ
P
ᴾ
KLUANE ARC
METAGRANITE, METAGRANODIORITE, & METAGABBRO
BOUNDED BY NENANA GLACIER FAULT
QUARTZITE, MARBLE, CALC-SCHIST, PELITIC SCHIST
BOUNDED BY DENALI FAULT

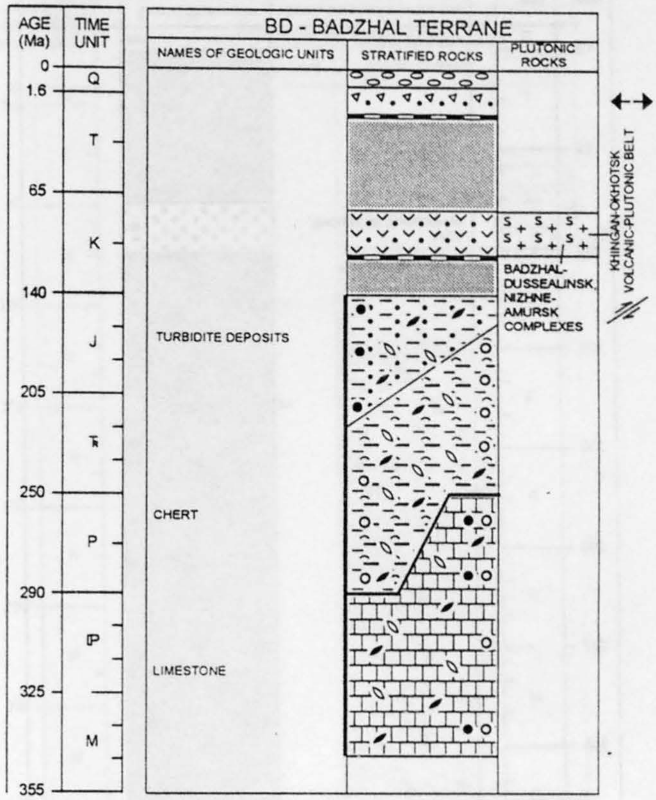

AGE (Ma)
TIME UNIT
ANV - ANIVA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
CONGLOMERATE, SANDSTONE
TURBIDITE DEPOSITS
CHERT
LIMESTONE
CHERT, BASALT, OPHIOLITE
??
K

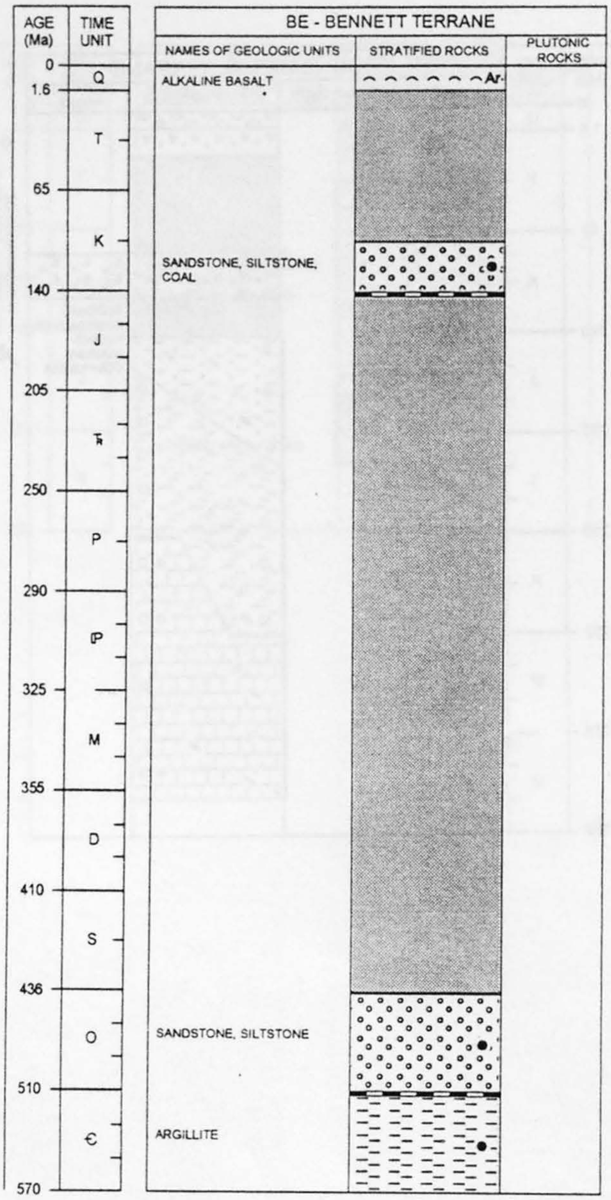

AGE (Ma)
TIME UNIT
AU - ARGUN TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
P
M
D
S
O
€
A
SHANDORSK SUITE: INTERMEDIATE VOLCANIC ROCKS
CONGLOMERATE
UST-UROVSK SUITE: LIMESTONE, DOLOMITE
APTACHINSK SUITE: LIMESTONE
BYSTRINSK SUITE: DOLOMITE
UROVSK SUITE
GAZIMUROVSK SERIES
GNEISS, AMPHIBOLITE, MARBLE, GRANULITE GNEISS
??


AGE (Ma)
TIME UNIT
AV - ALKATVAAM TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
250
KAMCHATKA-KORAK VOLCANIC BELT
KAKANAUT, CHUKOTKA, GANGUT, BARYKAV, GINTER, NEIKINVEEM, KENVUT, KENKEREN, & PEKYLNEI FORMATIONS
NUTYMOKIN FORMATION
??

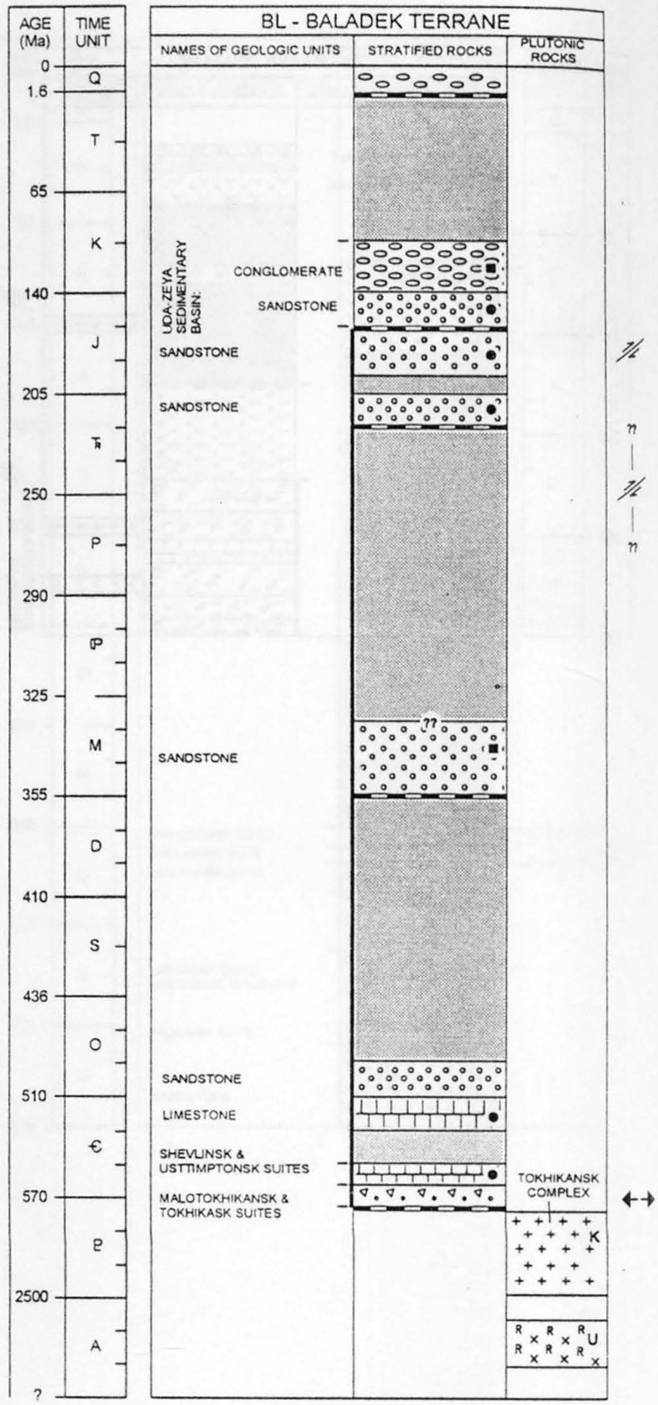

AGE (Ma)
TIME UNIT
AY - AYANSK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
250
P
290
325
M
355
D
410
S
436
O
510
ANDESITE & VOLCANICLASTIC ROCKS
MUDSTONE
JIKANDISNSK SUITE
TANCHINSK SUITE
ULU KANSK SUITE
LANTARSK SUITE: LIMESTONE, DOLOMITE
ALDOMSK SUITE
SANDSTONE
UDA VOLCANIC-PLUTONIC BELT
??


BA - BAKER TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
COLUMBIA RIVER BASALT GROUP
JOHN DAY & CLARNO FMS.
CONGLOMERATE
UNDIFFERENTIATED BURNT RIVER SCHIST, MINE RIDGE SCHIST, & ELKHORN RIDGE ARGILLITE, & NELSON MARBLE
CANYON MOUNTAIN COMPLEX
0
1.6
65
140
205
250
290
Q
T
K
J
P

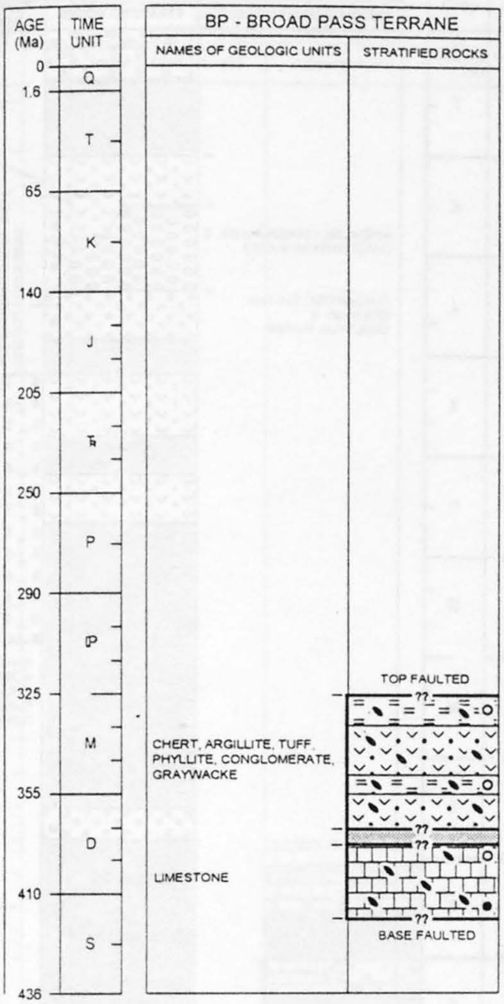

BD - BADZHAL TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
TURBIDITE DEPOSITS
CHERT
LIMESTONE
BADZHAL-DUSSEALINSK, NIZHNE-AMURSK COMPLEXES
KHINGAN-OKHOTSK VOLCANIC-PLUTONIC BELT
0
1.6
65
140
205
250
290
325
355
Q
T
K
J
P
M

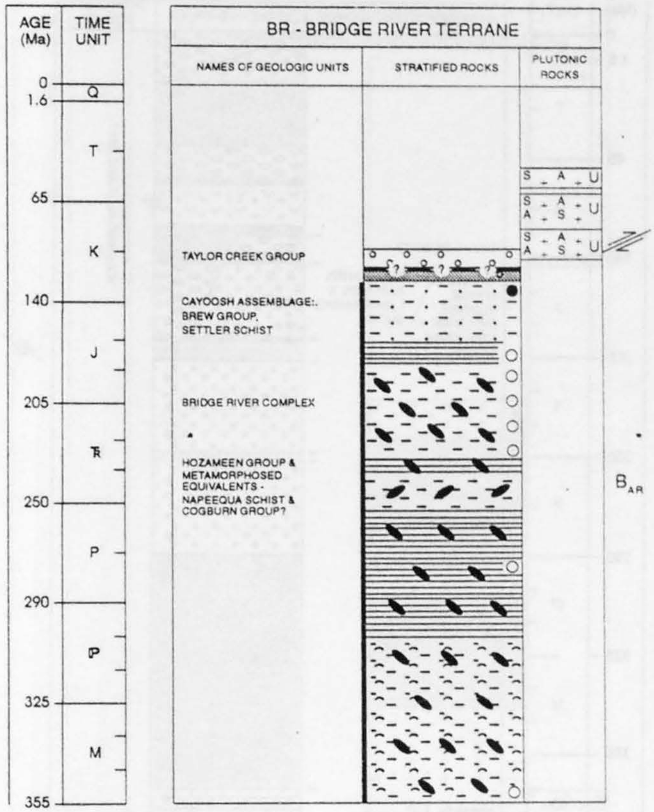


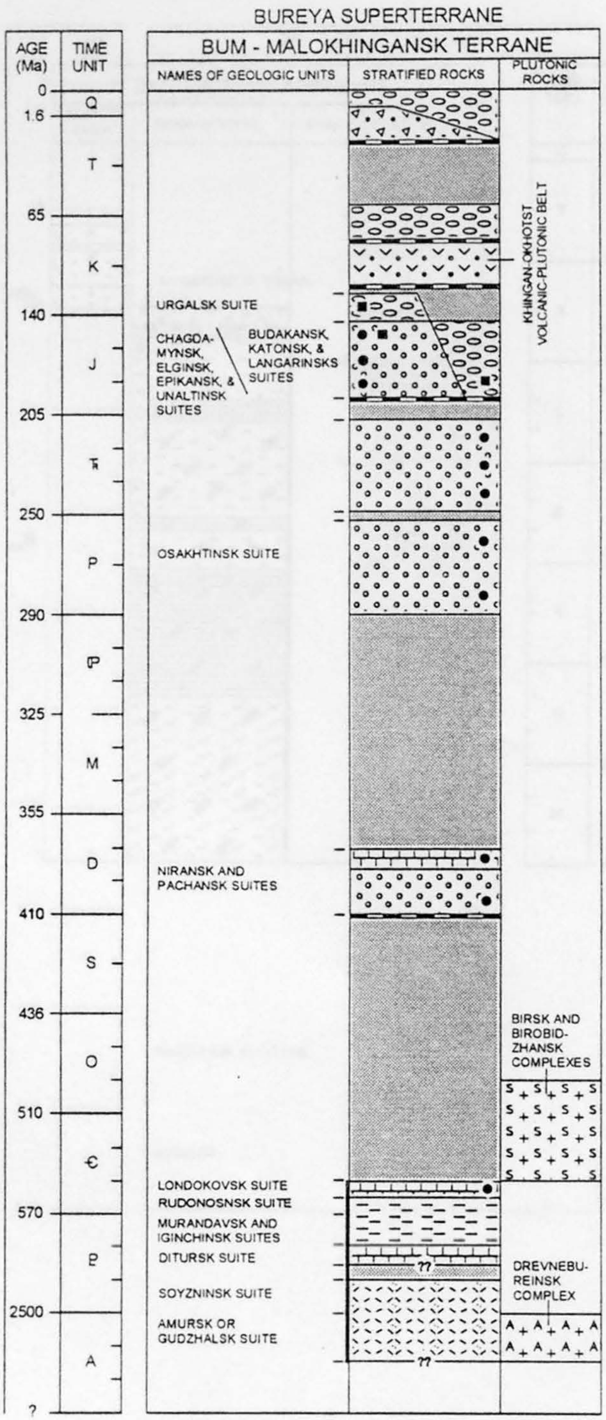
AGE (Ma)
TIME UNIT
BE - BENNETT TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
Q
T
K
J
Ŧ
P
₽
M
D
S
O
€
ALKALINE BASALT
Ar
SANDSTONE, SILTSTONE, COAL
SANDSTONE, SILTSTONE
ARGILLITE

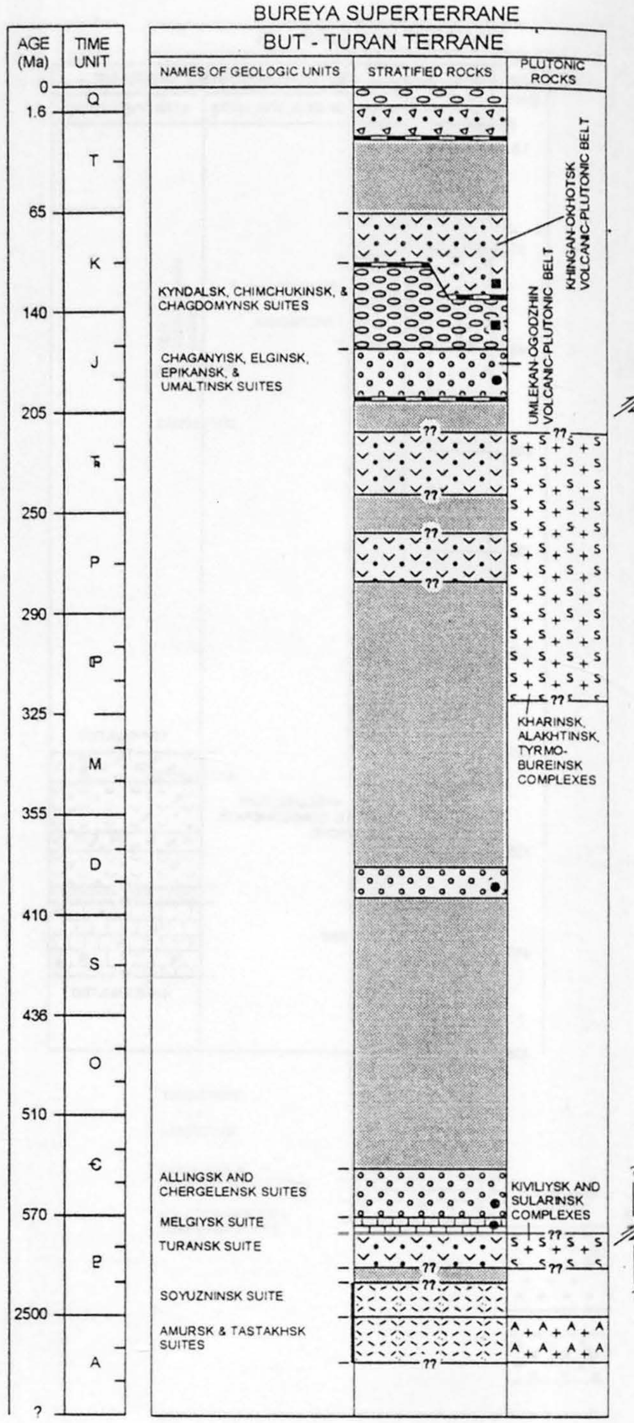


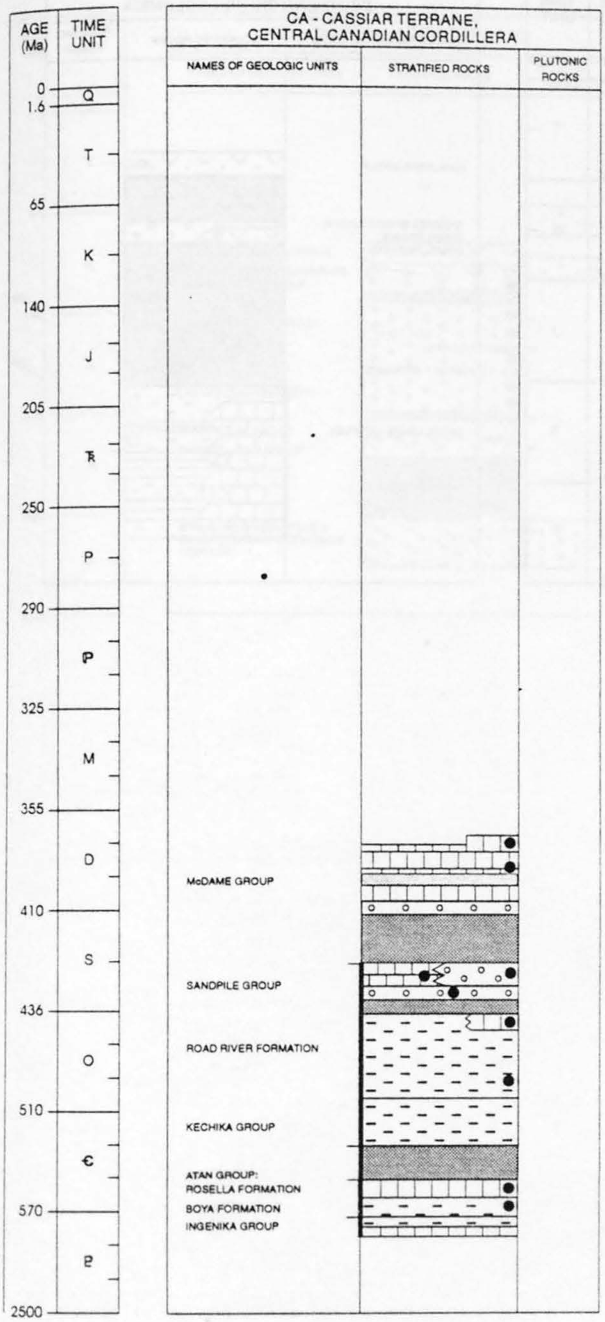
AGE (Ma)
TIME UNIT
BL - BALADEK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
Ŧ
P
₽
M
D
S
O
€
P
A
UDA-ZEYA SEDIMENTARY BASIN:
CONGLOMERATE
SANDSTONE
SANDSTONE
SANDSTONE
??
SANDSTONE
SANDSTONE
LIMESTONE
SHEVLINSK & USTTIMPTONSK SUITES
MALOTOKHIKANSK & TOKHIKASK SUITES
TOKHIKANSK COMPLEX
K
U
??
??

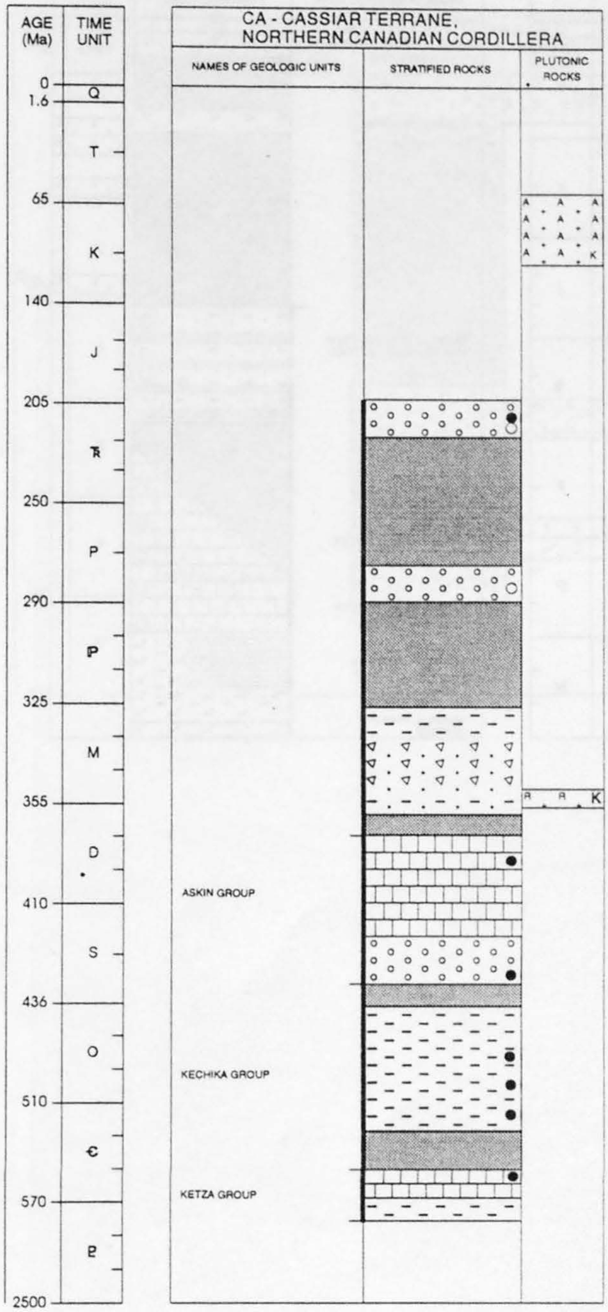

AGE (Ma)
TIME UNIT
BP - BROAD PASS TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
Q
T
K
J
P
M
D
S
TOP FAULTED
CHERT, ARGILLITE, TUFF, PHYLLITE, CONGLOMERATE, GRAYWACKE
LIMESTONE
BASE FAULTED

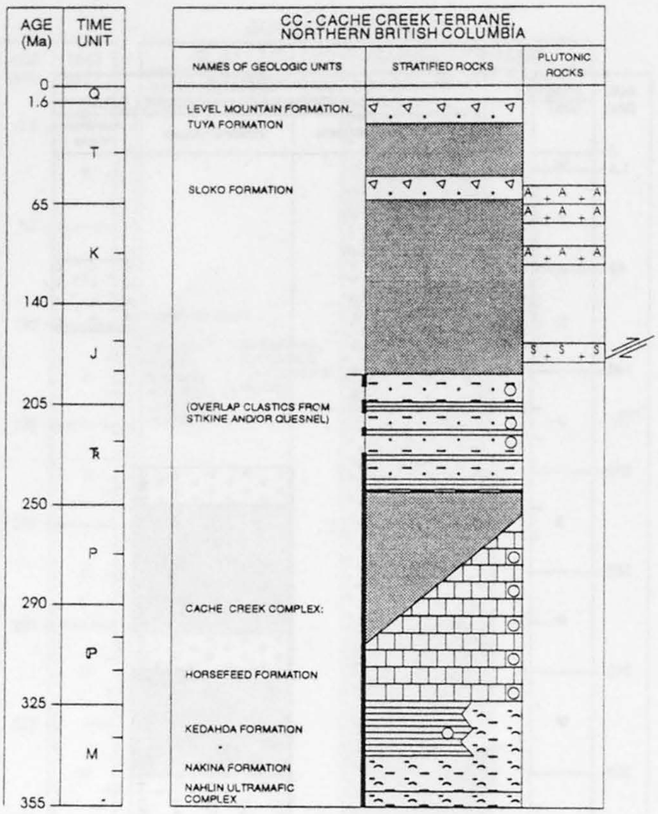

AGE (Ma)
TIME UNIT
BR - BRIDGE RIVER TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
Q
T
K
J
P
M
TAYLOR CREEK GROUP
CAYOOSH ASSEMBLAGE: BREW GROUP, SETTLER SCHIST
BRIDGE RIVER COMPLEX
HOZAMEEN GROUP & METAMORPHOSED EQUIVALENTS - NAPEEQUA SCHIST & COGBURN GROUP?

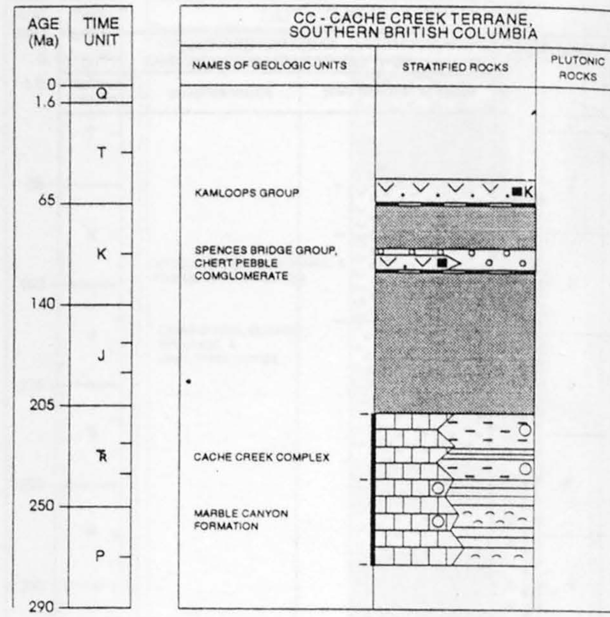

BUREYA SUPERTERRANE
BUM - MALOKHINGANSK TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
Ŧ
P
IP
M
D
S
O
Є
Ᵽ
A
URGALSK SUITE
CHAGDA-MYNSK, ELGINSK, EPIKANSK, & UNALTINSK SUITES
BUDAKANSK, KATONSK, & LANGARINSKS SUITES
OSAKHTINSK SUITE
NIRANSK AND PACHANSK SUITES
LONDOKOVSK SUITE
RUDONOSNSK SUITE
MURANDAVSK AND IGINCHINSK SUITES
DITURSK SUITE
SOYZNINSK SUITE
AMURSK OR GUDZHALSK SUITE
KHINGAN-OKHOTST VOLCANIC-PLUTONIC BELT
BIRSK AND BIROBID-ZHANSK COMPLEXES
DREVNEBU-REINSK COMPLEX

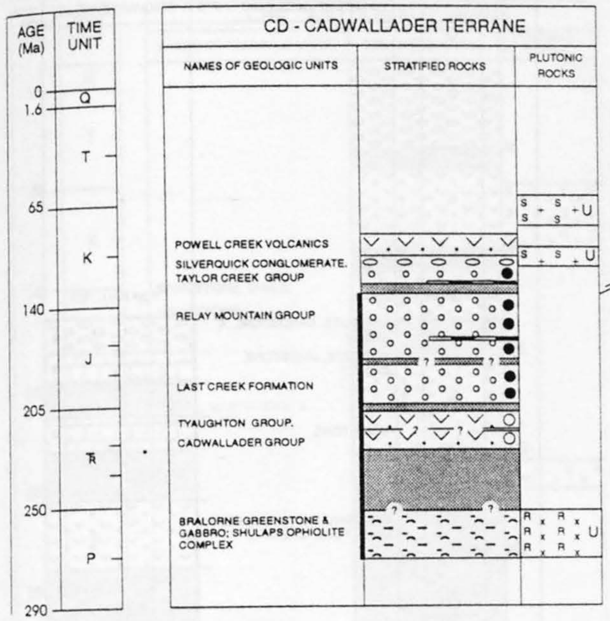

BUREYA SUPERTERRANE
BUT - TURAN TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
Ŧ
P
IP
M
D
S
O
Є
Ᵽ
A
KYNDALSK, CHIMCHUKINSK, & CHAGDOMYNSK SUITES
CHAGANYISK, ELGINSK, EPIKANSK, & UMALTINSK SUITES
ALLINGSK AND CHERGELENSK SUITES
MELGIYSK SUITE
TURANSK SUITE
SOYUZNINSK SUITE
AMURSK & TASTAKHSK SUITES
KHINGAN-OKHOTSK VOLCANIC-PLUTONIC BELT
UMLEKAN-OGODZHIN VOLCANIC-PLUTONIC BELT
KHARINSK, ALAKHTINSK, TYRMO-BUREINSK COMPLEXES
KIVILIYSK AND SULARINSK COMPLEXES

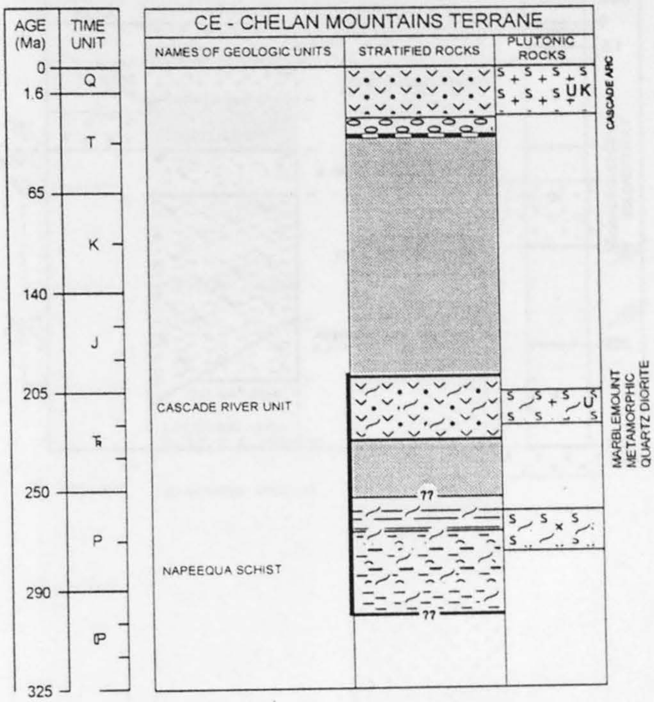

AGE (Ma)
TIME UNIT
CA - CASSIAR TERRANE, CENTRAL CANADIAN CORDILLERA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
McDAME GROUP
SANDPILE GROUP
ROAD RIVER FORMATION
KECHIKA GROUP
ATAN GROUP: ROSELLA FORMATION
BOYA FORMATION
INGENIKA GROUP

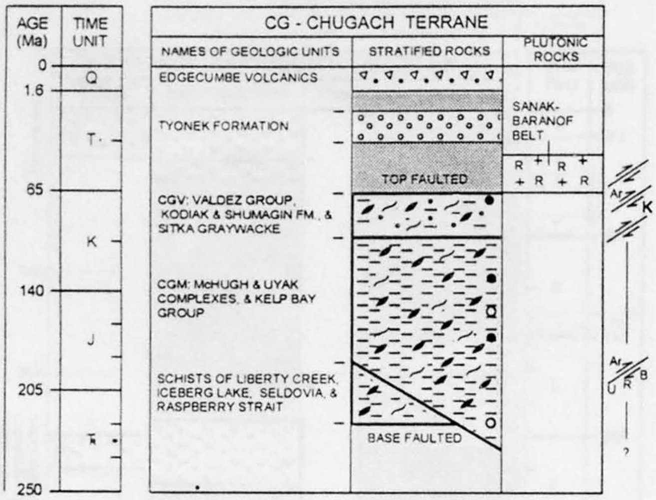

AGE (Ma)
TIME UNIT
CA - CASSIAR TERRANE, NORTHERN CANADIAN CORDILLERA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
ASKIN GROUP
KECHIKA GROUP
KETZA GROUP

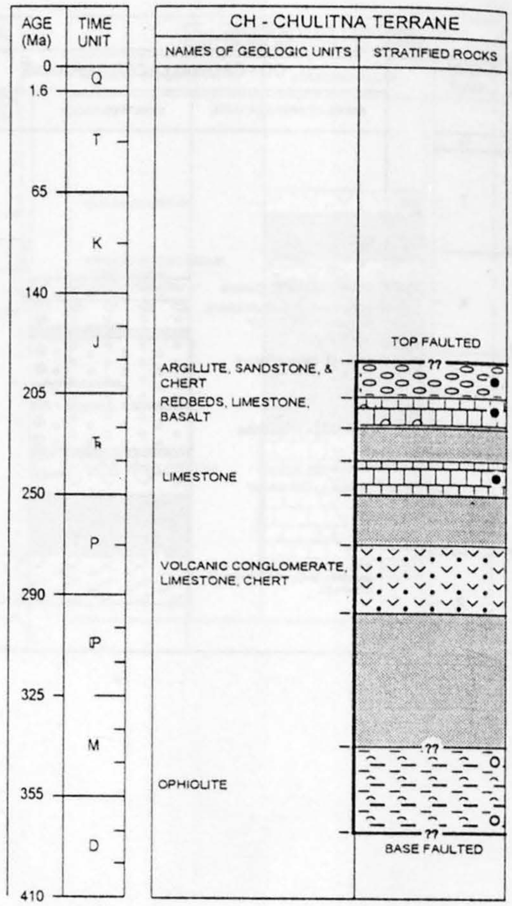

AGE (Ma)
TIME UNIT
CC - CACHE CREEK TERRANE, NORTHERN BRITISH COLUMBIA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
250
P
290
325
M
355
LEVEL MOUNTAIN FORMATION, TUYA FORMATION
SLOKO FORMATION
(OVERLAP CLASTICS FROM STIKINE AND/OR QUESNEL)
CACHE CREEK COMPLEX:
HORSEFEED FORMATION
KEDAHDA FORMATION
NAKINA FORMATION
NAHLIN ULTRAMAFIC COMPLEX

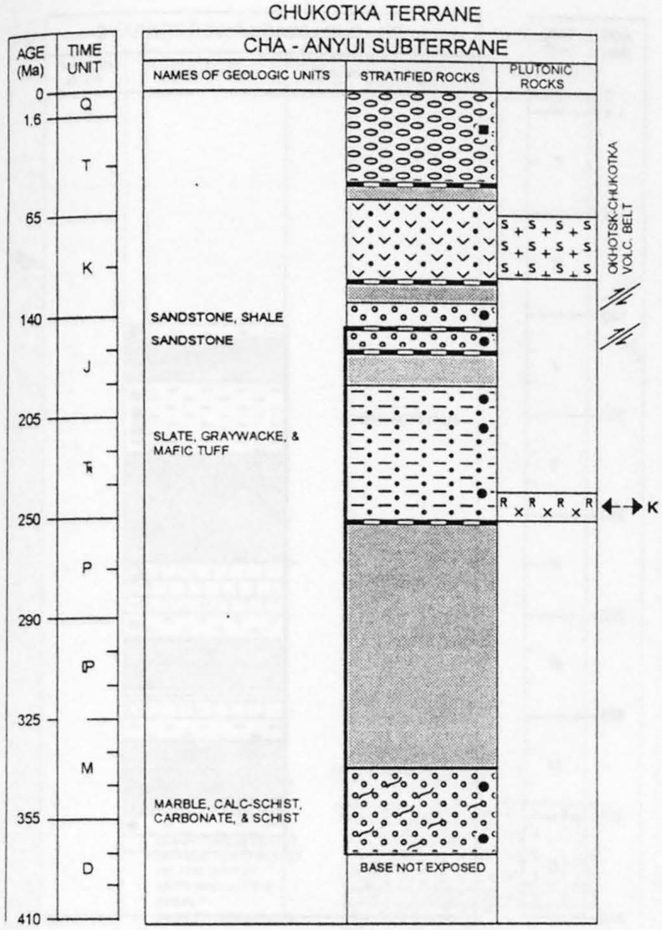

AGE (Ma)
TIME UNIT
CC - CACHE CREEK TERRANE, SOUTHERN BRITISH COLUMBIA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
250
P
290
KAMLOOPS GROUP
SPENCES BRIDGE GROUP, CHERT PEBBLE COMGLOMERATE
CACHE CREEK COMPLEX
MARBLE CANYON FORMATION

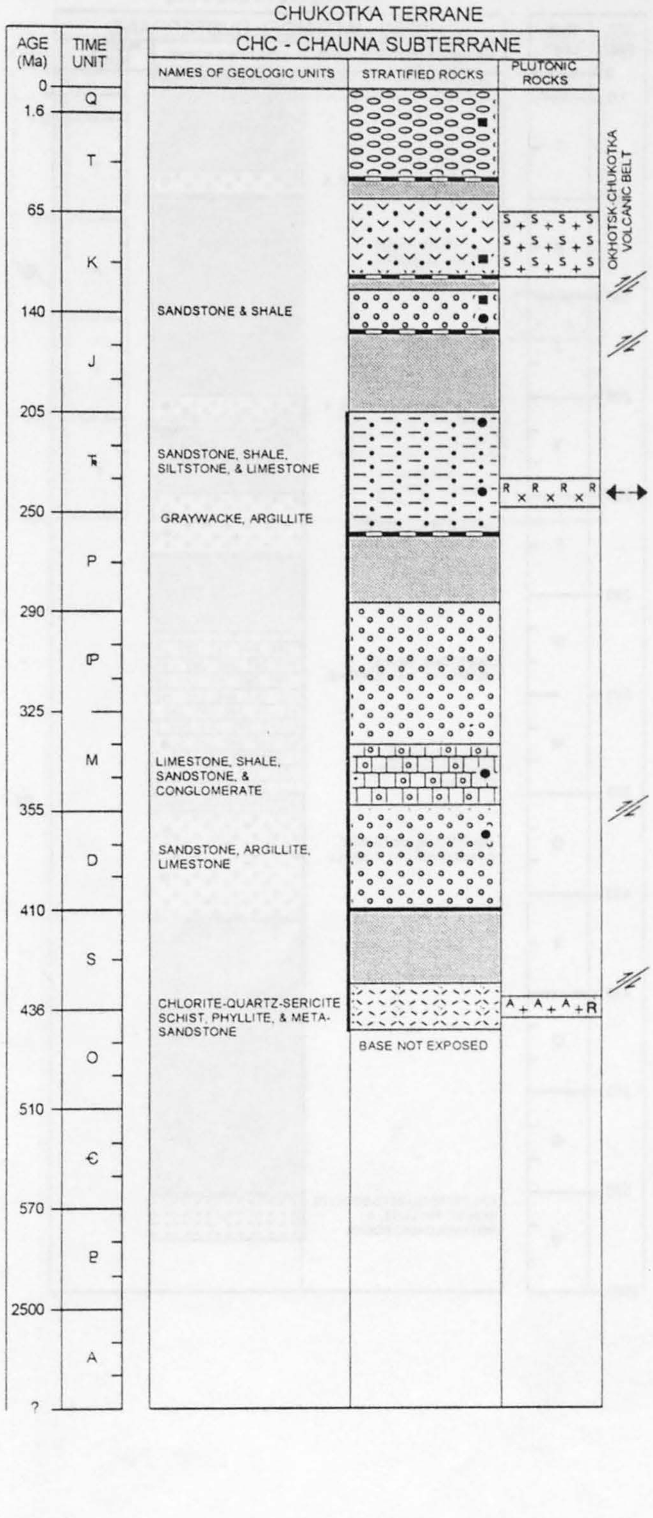

CD - CADWALLADER TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
Q
T
K
J
Ŧ
P
POWELL CREEK VOLCANICS
SILVERQUICK CONGLOMERATE.
TAYLOR CREEK GROUP
RELAY MOUNTAIN GROUP
LAST CREEK FORMATION
TYAUGHTON GROUP.
CADWALLADER GROUP
BRALORNE GREENSTONE & GABBRO; SHULAPS OPHIOLITE COMPLEX

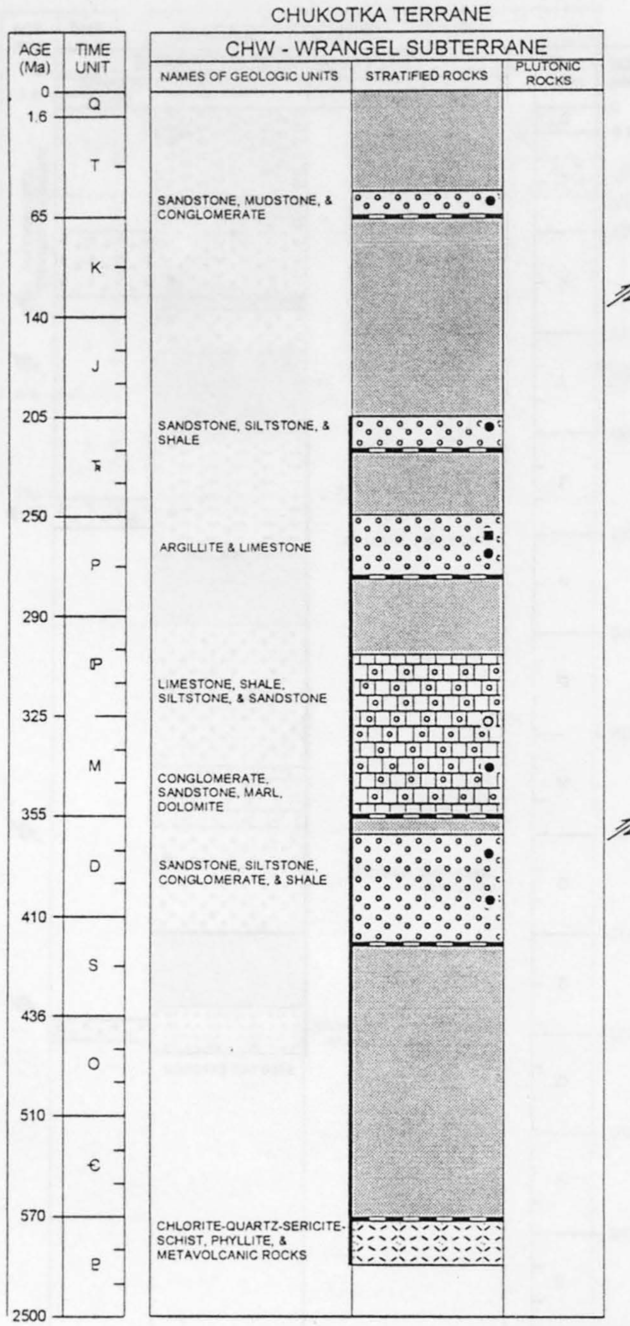

CE - CHELAN MOUNTAINS TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
Q
T
K
J
Ŧ
P
ℙ
CASCADE RIVER UNIT
NAPEEQUA SCHIST
CASCADE ARC
MARBLEMOUNT METAMORPHIC QUARTZ DIORITE

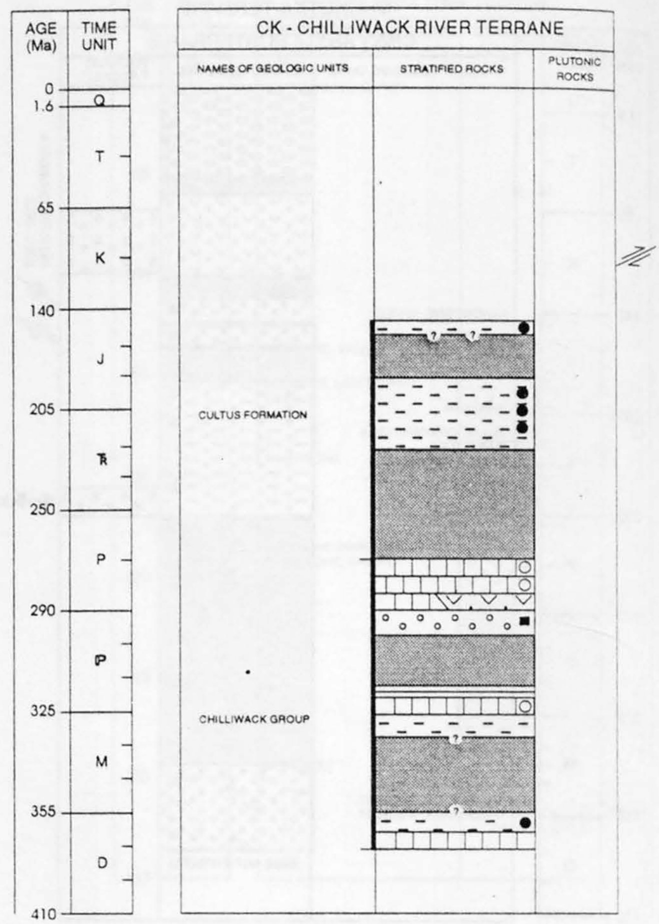

AGE (Ma)
TIME UNIT
CG - CHUGACH TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
Ѫ
EDGECUMBE VOLCANICS
TYONEK FORMATION
SANAK-BARANOF BELT
TOP FAULTED
CGV: VALDEZ GROUP, KODIAK & SHUMAGIN FM., & SITKA GRAYWACKE
CGM: McHUGH & UYAK COMPLEXES, & KELP BAY GROUP
SCHISTS OF LIBERTY CREEK, ICEBERG LAKE, SELDOVIA, & RASPBERRY STRAIT
BASE FAULTED
K
B

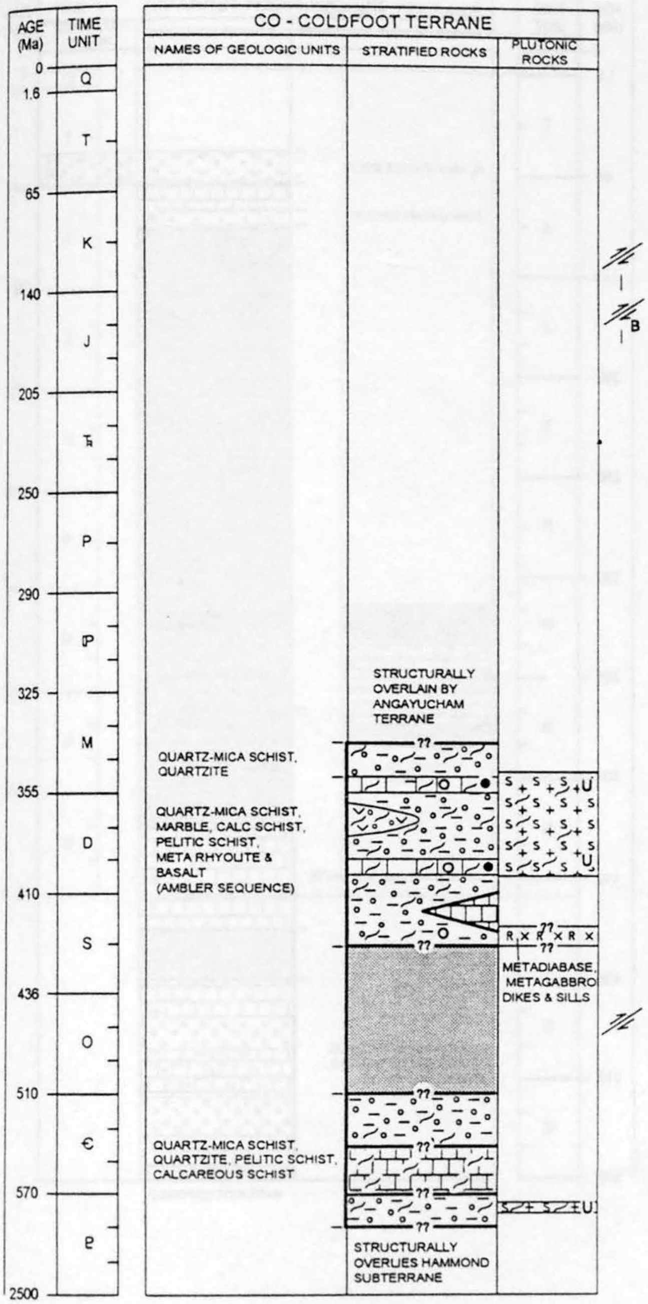

AGE (Ma)
TIME UNIT
CH - CHULITNA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
Ѫ
P
IP
M
D
TOP FAULTED
ARGILLITE, SANDSTONE, & CHERT
REDBEDS, LIMESTONE, BASALT
LIMESTONE
VOLCANIC CONGLOMERATE, LIMESTONE, CHERT
OPHIOLITE
BASE FAULTED


CHUKOTKA TERRANE
CHA - ANYUI SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
Ŧ
P
ℙ
M
D
SANDSTONE, SHALE
SANDSTONE
SLATE, GRAYWACKE, & MAFIC TUFF
MARBLE, CALC-SCHIST, CARBONATE, & SCHIST
BASE NOT EXPOSED
OKHOTSK-CHUKOTKA VOLC. BELT
K

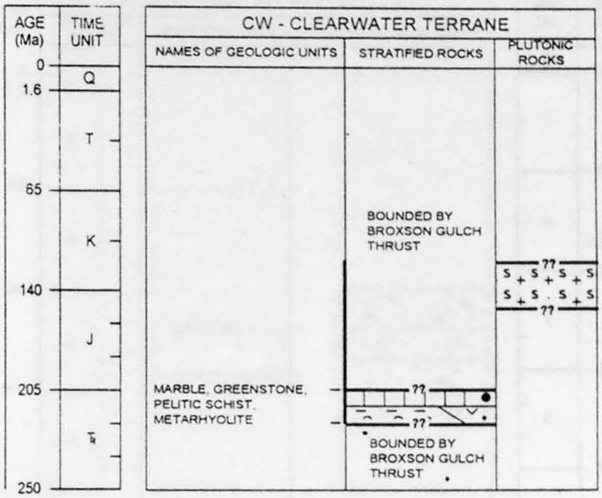

CHUKOTKA TERRANE
CHC - CHAUNA SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
Ŧ
P
ℙ
M
D
S
O
€
P
A
SANDSTONE & SHALE
SANDSTONE, SHALE, SILTSTONE, & LIMESTONE
GRAYWACKE, ARGILLITE
LIMESTONE, SHALE, SANDSTONE, & CONGLOMERATE
SANDSTONE, ARGILLITE, LIMESTONE
CHLORITE-QUARTZ-SERICITE SCHIST, PHYLLITE, & META-SANDSTONE
BASE NOT EXPOSED
OKHOTSK-CHUKOTKA VOLCANIC BELT


CHUKOTKA TERRANE
CHW - WRANGEL SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SANDSTONE, MUDSTONE, & CONGLOMERATE
SANDSTONE, SILTSTONE, & SHALE
ARGILLITE & LIMESTONE
LIMESTONE, SHALE, SILTSTONE, & SANDSTONE
CONGLOMERATE, SANDSTONE, MARL, DOLOMITE
SANDSTONE, SILTSTONE, CONGLOMERATE, & SHALE
CHLORITE-QUARTZ-SERICITE-SCHIST, PHYLLITE, & METAVOLCANIC ROCKS

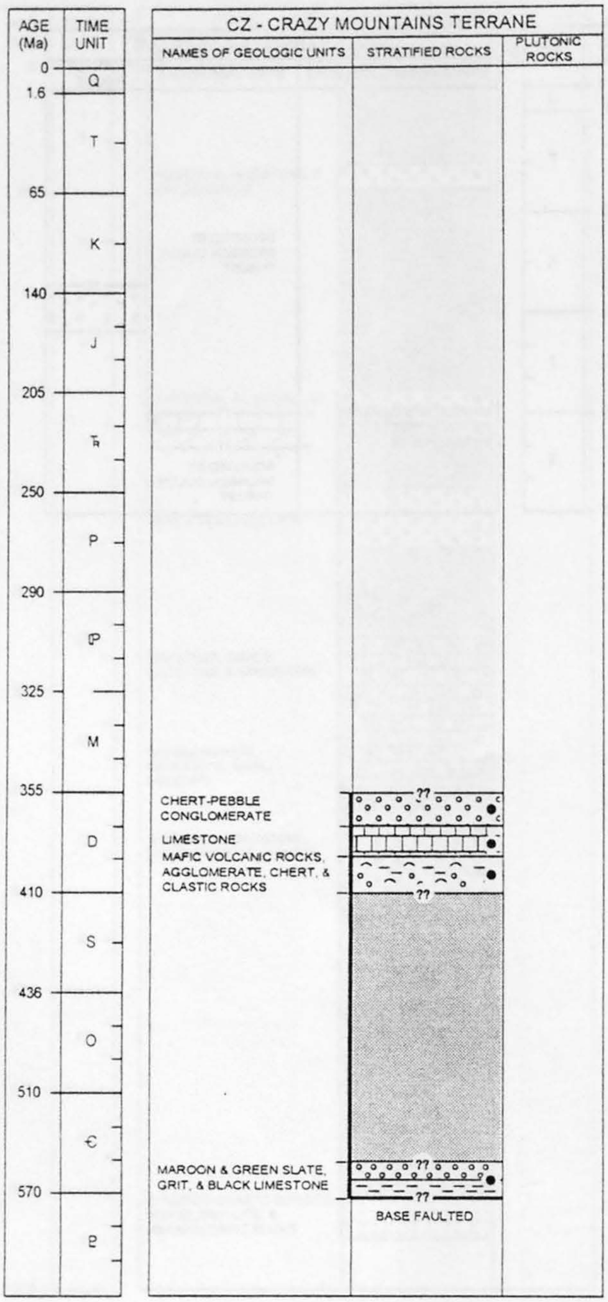

CK - CHILLIWACK RIVER TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
CULTUS FORMATION
CHILLIWACK GROUP

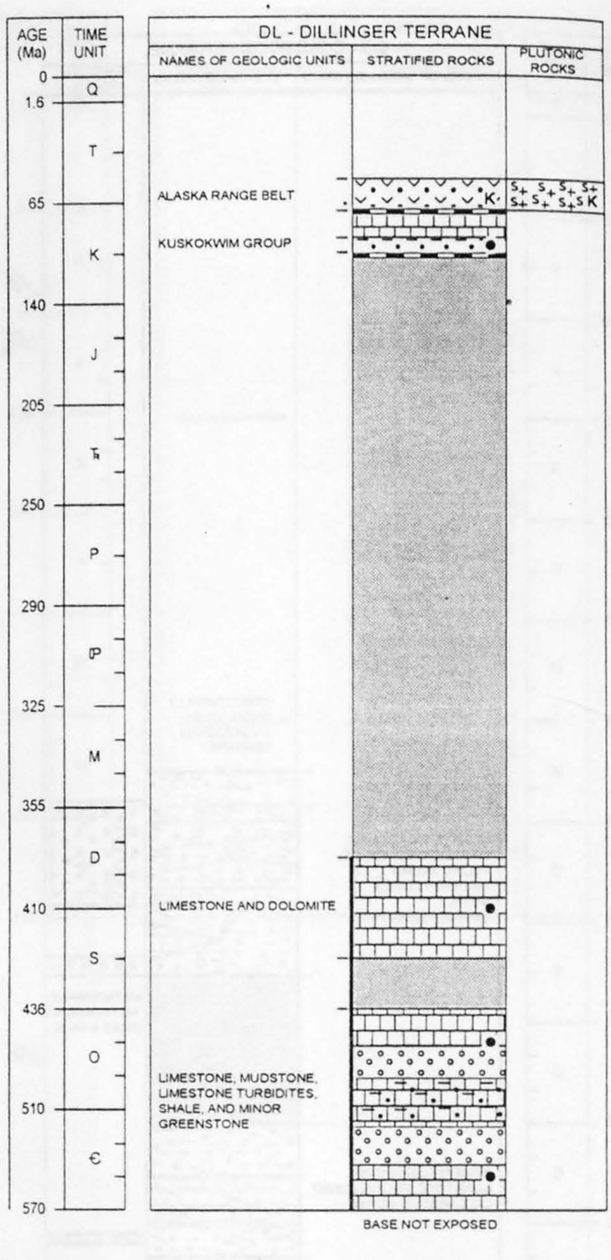


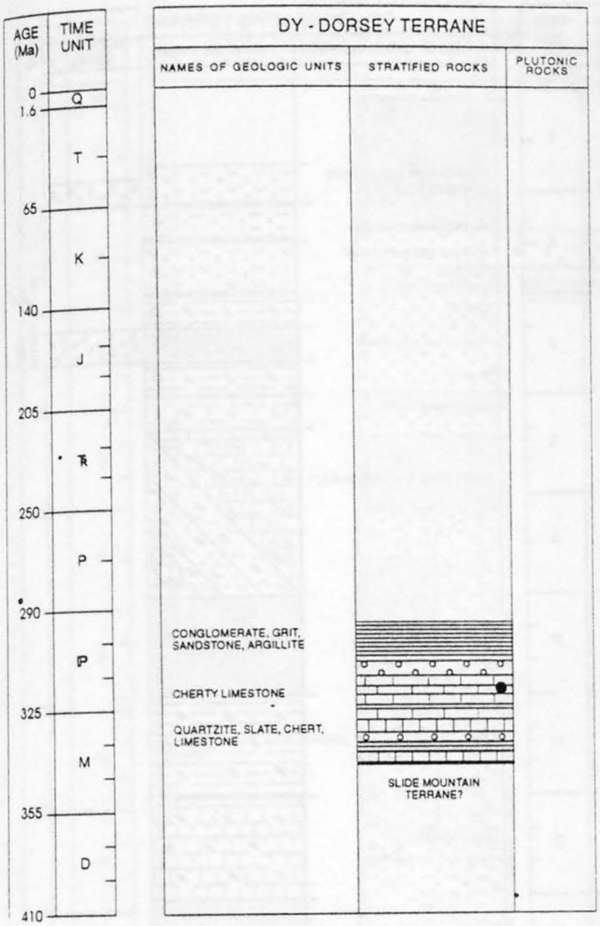
AGE (Ma)
TIME UNIT
CO - COLDFOOT TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
P
M
D
S
O
B
STRUCTURALLY OVERLAIN BY ANGAYUCHAM TERRANE
QUARTZ-MICA SCHIST, QUARTZITE
QUARTZ-MICA SCHIST, MARBLE, CALC SCHIST, PELITIC SCHIST, META RHYOLITE & BASALT (AMBLER SEQUENCE)
METADIABASE, METAGABBRO DIKES & SILLS
QUARTZ-MICA SCHIST, QUARTZITE, PELITIC SCHIST, CALCAREOUS SCHIST
STRUCTURALLY OVERLIES HAMMOND SUBTERRANE

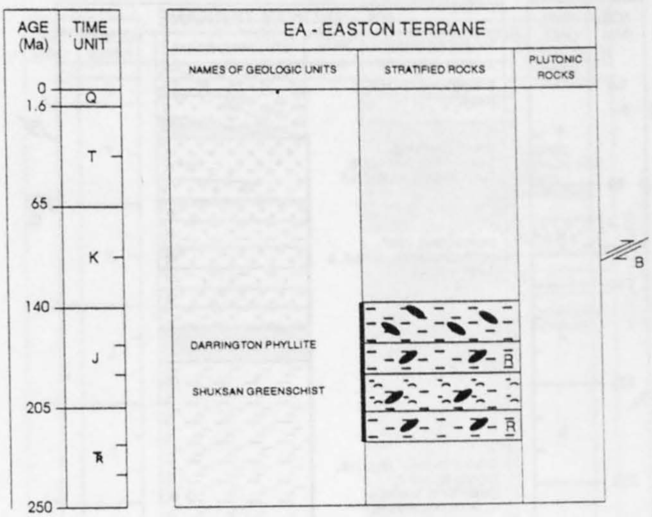


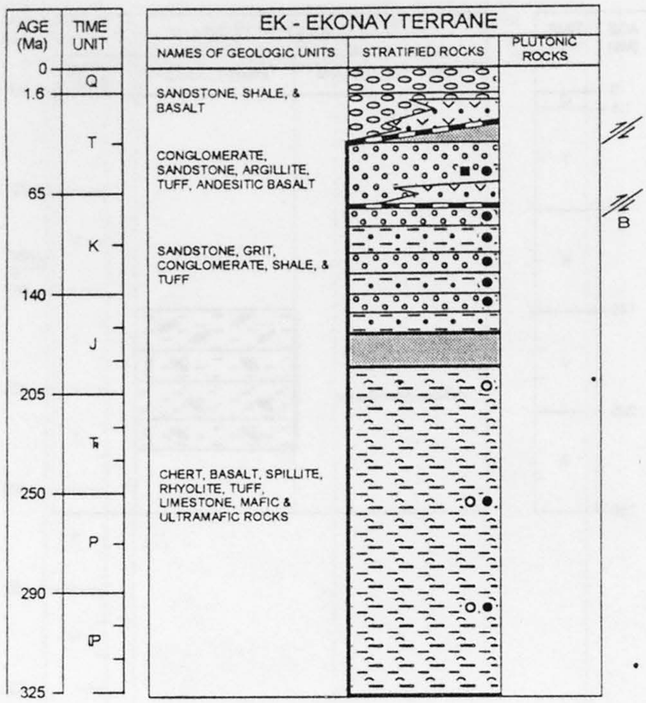
AGE (Ma)
TIME UNIT
CW - CLEARWATER TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
BOUNDED BY BROXSON GULCH THRUST
MARBLE, GREENSTONE, PELITIC SCHIST, METARHYOLITE
BOUNDED BY BROXSON GULCH THRUST


CZ - CRAZY MOUNTAINS TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
Q
T
K
J
Ŧ
P
ℙ
M
D
S
O
€
Ᵽ
CHERT-PEBBLE CONGLOMERATE
LIMESTONE
MAFIC VOLCANIC ROCKS, AGGLOMERATE, CHERT, & CLASTIC ROCKS
MAROON & GREEN SLATE, GRIT, & BLACK LIMESTONE
BASE FAULTED

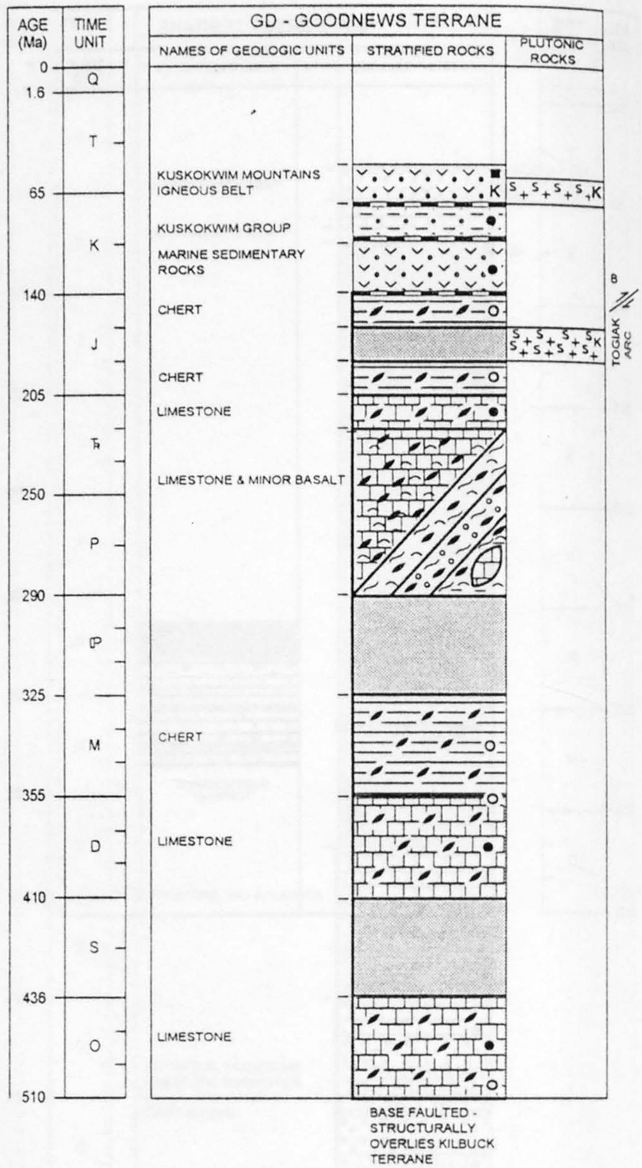

DL - DILLINGER TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
Q
T
K
J
Ŧ
P
ℙ
M
D
S
O
€
ALASKA RANGE BELT
KUSKOKWIM GROUP
LIMESTONE AND DOLOMITE
LIMESTONE, MUDSTONE, LIMESTONE TURBIDITES, SHALE, AND MINOR GREENSTONE
BASE NOT EXPOSED


AGE (Ma)
TIME UNIT
DY - DORSEY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
Ŧ
250
P
290
P
325
M
355
D
410
CONGLOMERATE, GRIT, SANDSTONE, ARGILLITE
CHERTY LIMESTONE
QUARTZITE, SLATE, CHERT, LIMESTONE
SLIDE MOUNTAIN TERRANE?

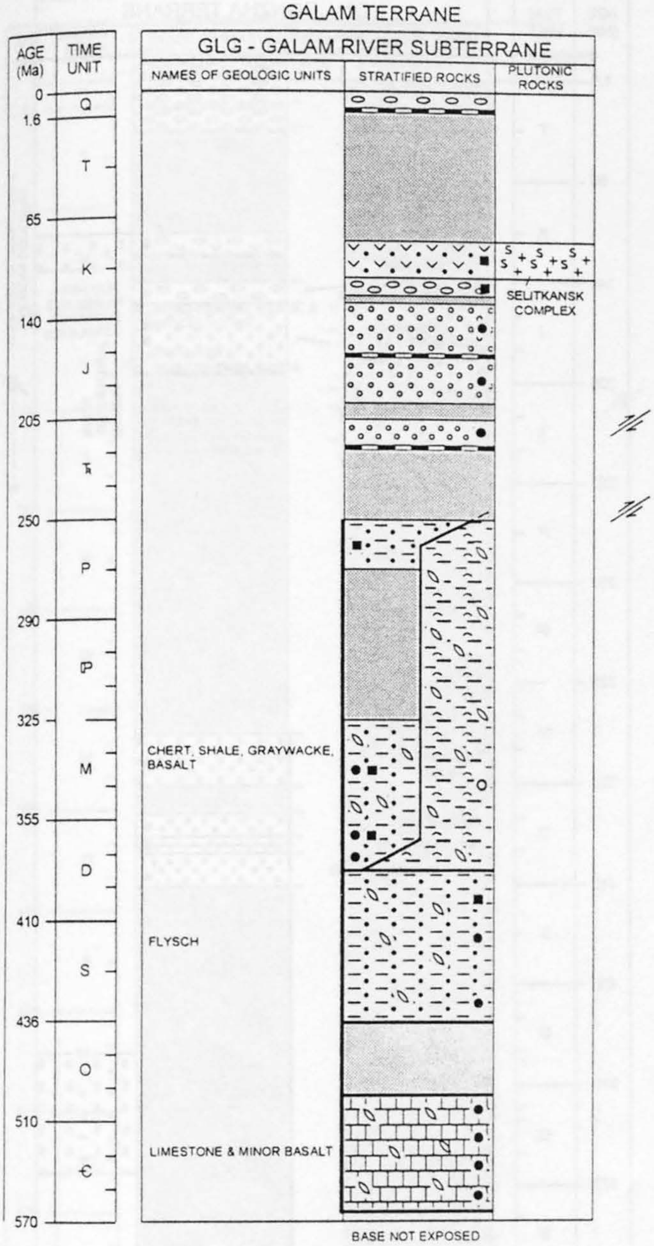

AGE (Ma)
TIME UNIT
EA - EASTON TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
Ŧ
250
DARRINGTON PHYLLITE
SHUKSAN GREENSCHIST
B

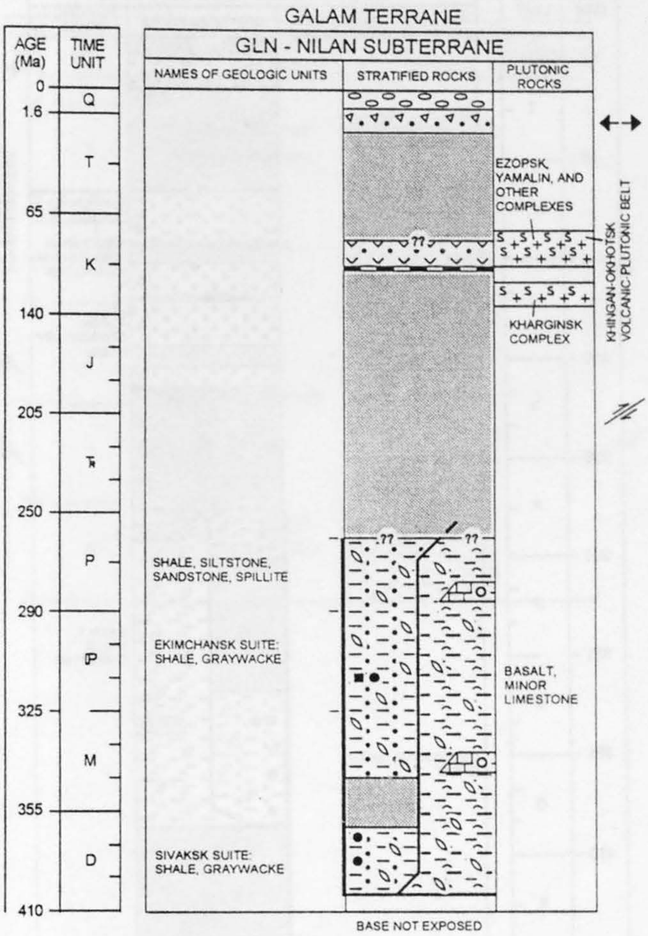


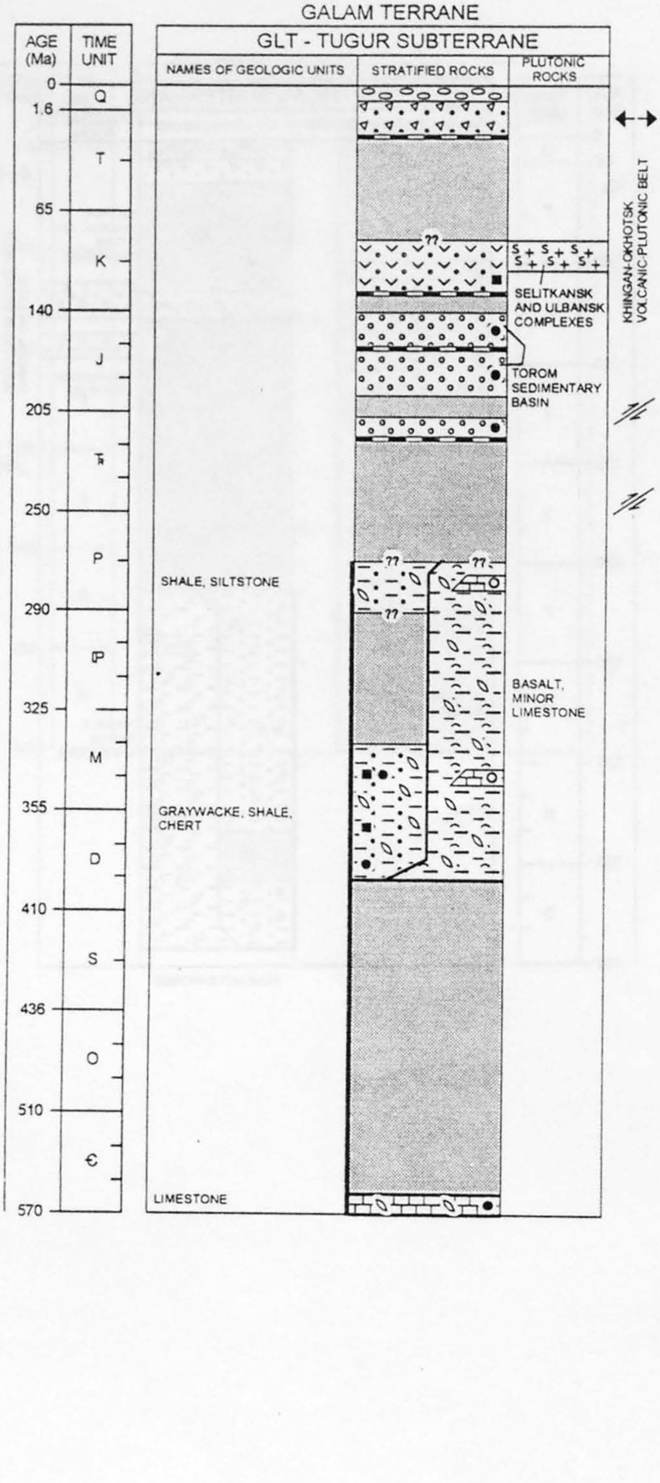
EK - EKONAY TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SANDSTONE, SHALE, & BASALT
CONGLOMERATE, SANDSTONE, ARGILLITE, TUFF, ANDESITIC BASALT
SANDSTONE, GRIT, CONGLOMERATE, SHALE, & TUFF
CHERT, BASALT, SPILLITE, RHYOLITE, TUFF, LIMESTONE, MAFIC & ULTRAMAFIC ROCKS
B

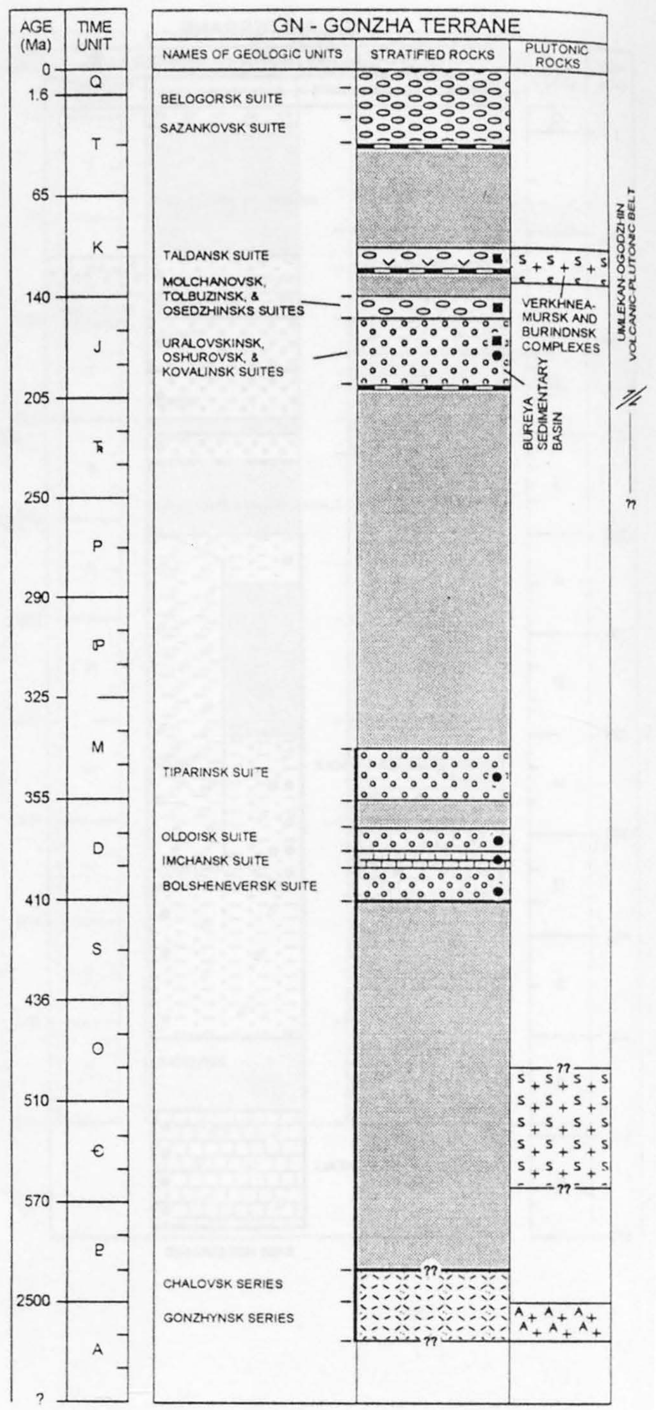


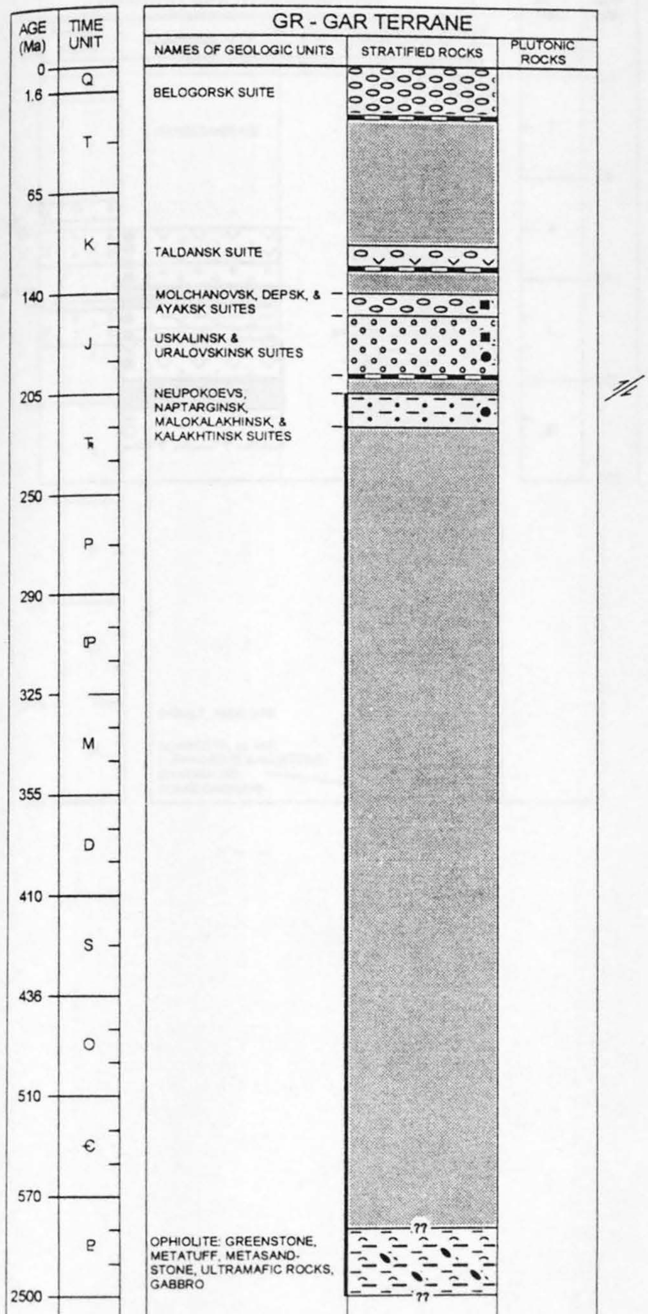
GD - GOODNEWS TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
KUSKOKWIM MOUNTAINS IGNEOUS BELT
KUSKOKWIM GROUP
MARINE SEDIMENTARY ROCKS
CHERT
CHERT
LIMESTONE
LIMESTONE & MINOR BASALT
CHERT
LIMESTONE
LIMESTONE
BASE FAULTED - STRUCTURALLY OVERLIES KILBUCK TERRANE
TOGIAK ARC
B

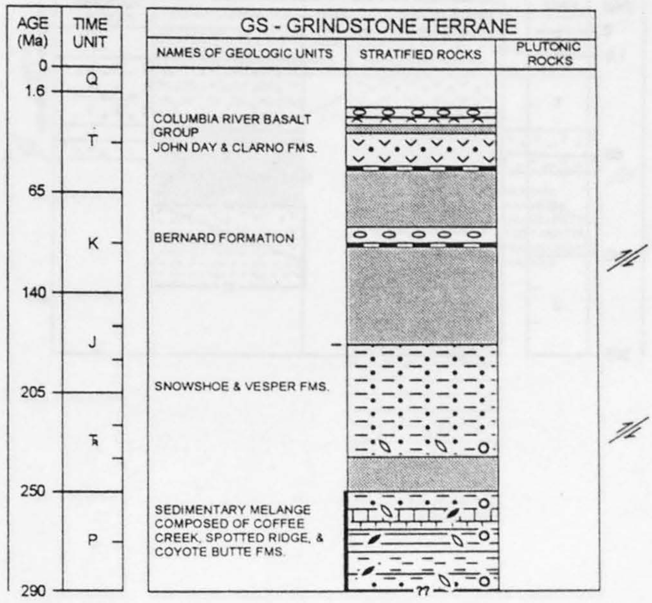

GALAM TERRANE
GLG - GALAM RIVER SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SELITKANSK COMPLEX
CHERT, SHALE, GRAYWACKE, BASALT
FLYSCH
LIMESTONE & MINOR BASALT
BASE NOT EXPOSED

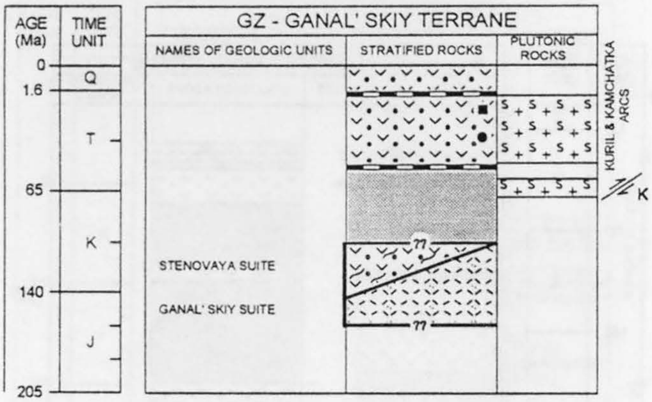

GALAM TERRANE
GLN - NILAN SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
EZOPSK, YAMALIN, AND OTHER COMPLEXES
KHARGINSK COMPLEX
KHINGAN-OKHOTSK VOLCANIC-PLUTONIC BELT
SHALE, SILTSTONE, SANDSTONE, SPILLITE
EKIMCHANSK SUITE: SHALE, GRAYWACKE
BASALT, MINOR LIMESTONE
SIVAKSK SUITE: SHALE, GRAYWACKE
BASE NOT EXPOSED

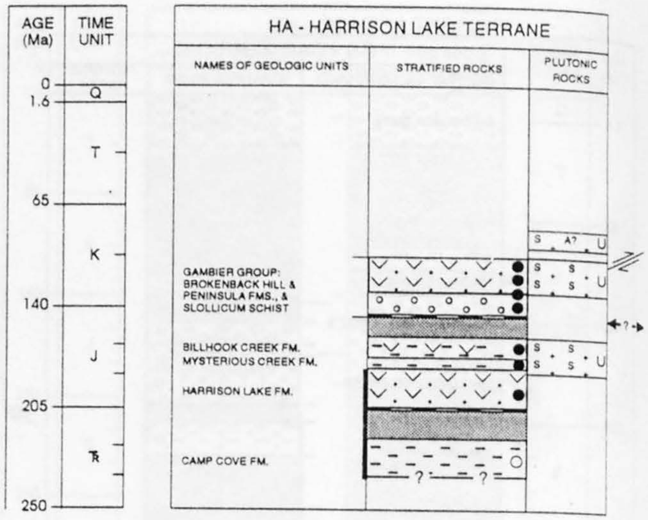

GALAM TERRANE
GLT - TUGUR SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SELITKANSK AND ULBANSK COMPLEXES
TOROM SEDIMENTARY BASIN
KHINGAN-OKHOTSK VOLCANIC-PLUTONIC BELT
SHALE, SILTSTONE
BASALT, MINOR LIMESTONE
GRAYWACKE, SHALE, CHERT
LIMESTONE

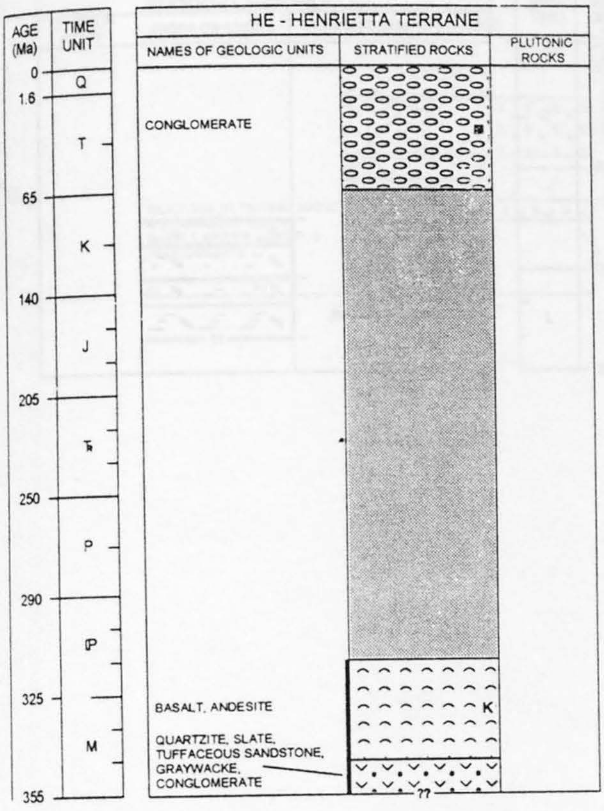

GN - GONZHA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
BELOGORSK SUITE
SAZANKOVSK SUITE
TALDANSK SUITE
MOLCHANOVSK, TOLBUZINSK, & OSEDZHINSKS SUITES
URALOVSKINSK, OSHUROVSK, & KOVALINSK SUITES
VERKHNEA-MURSK AND BURINDNSK COMPLEXES
BUREYA SEDIMENTARY BASIN
UMLEKAN-OGODZHIN VOLCANIC-PLUTONIC BELT
TIPARINSK SUITE
OLDOISK SUITE
IMCHANSK SUITE
BOLSHENEVERSK SUITE
CHALOVSK SERIES
GONZHYNSK SERIES

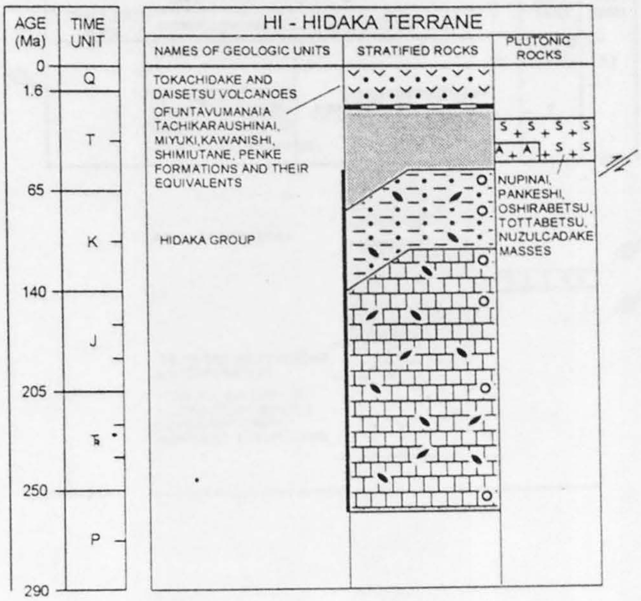

GR - GAR TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
P
M
D
S
O
A
BELOGORSK SUITE
TALDANSK SUITE
MOLCHANOVSK, DEPSK, & AYAKSK SUITES
USKALINSK & URALOVSKINSK SUITES
NEUPOKOEVS, NAPTARGINSK, MALOKALAKHINSK, & KALAKHTINSK SUITES
OPHIOLITE: GREENSTONE, METATUFF, METASANDSTONE, ULTRAMAFIC ROCKS, GABBRO
??

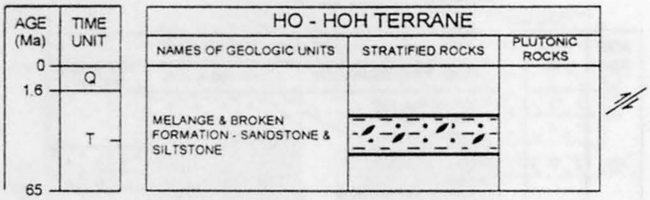

GS - GRINDSTONE TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
Q
T
K
J
P
COLUMBIA RIVER BASALT GROUP
JOHN DAY & CLARNO FMS.
BERNARD FORMATION
SNOWSHOE & VESPER FMS.
SEDIMENTARY MELANGE COMPOSED OF COFFEE CREEK, SPOTTED RIDGE, & COYOTE BUTTE FMS.
??

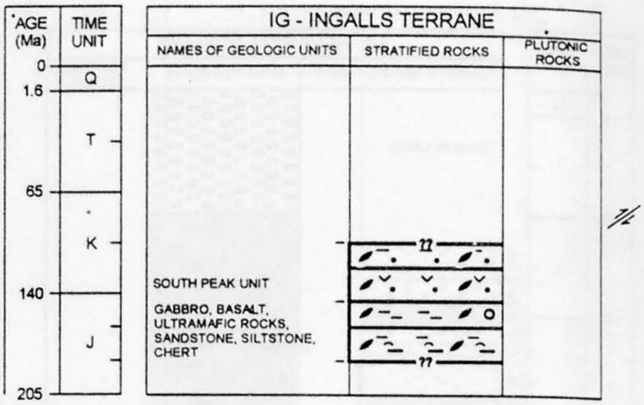

AGE (Ma)
TIME UNIT
GZ - GANAL' SKIY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
KURIL & KAMCHATKA ARCS
0
1.6
65
140
205
Q
T
K
J
STENOVAYA SUITE
GANAL' SKIY SUITE

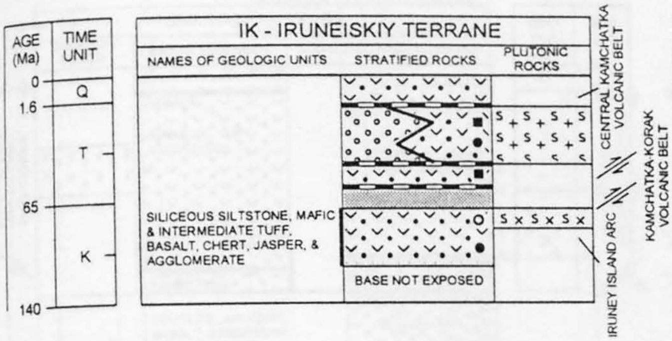

AGE (Ma)
TIME UNIT
HA - HARRISON LAKE TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
GAMBIER GROUP: BROKENBACK HILL & PENINSULA FMS., & SLOLLICUM SCHIST
BILLHOOK CREEK FM. MYSTERIOUS CREEK FM.
HARRISON LAKE FM.
CAMP COVE FM.

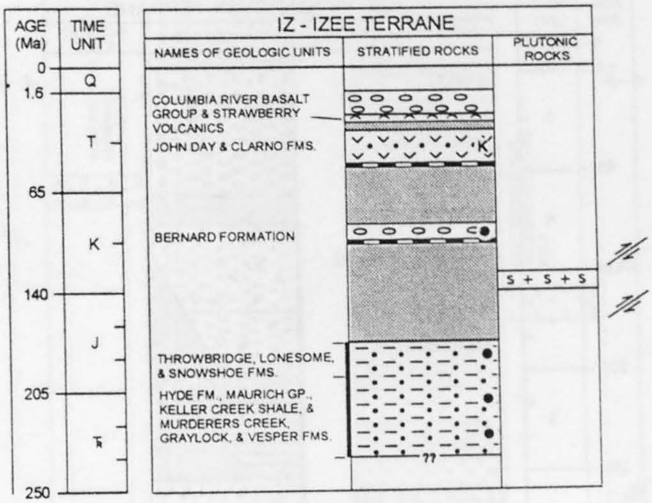

HE - HENRIETTA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
CONGLOMERATE
BASALT, ANDESITE
QUARTZITE, SLATE, TUFFACEOUS SANDSTONE, GRAYWACKE, CONGLOMERATE
??

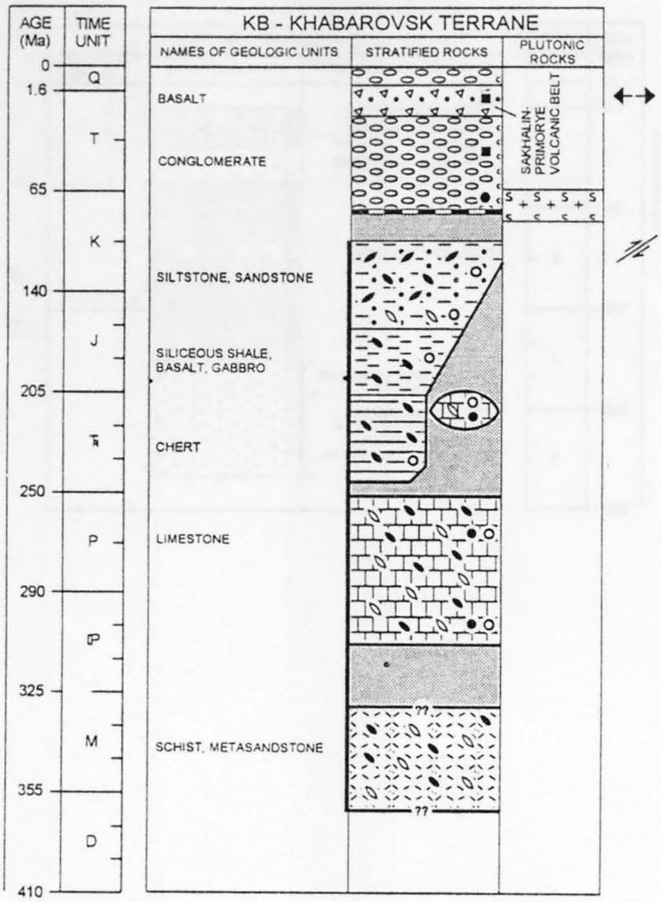

HI - HIDAKA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
TOKACHIDAKE AND DAISETSU VOLCANOES
OFUNTAVUMANAIA TACHIKARAUSHINAI, MIYUKI,KAWANISHI, SHIMIUTANE, PENKE FORMATIONS AND THEIR EQUIVALENTS
HIDAKA GROUP
NUPINAI, PANKESHI, OSHIRABETSU, TOTTABETSU, NUZULCADAKE MASSES


HO - HOH TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
Q
T
MELANGE & BROKEN FORMATION - SANDSTONE & SILTSTONE

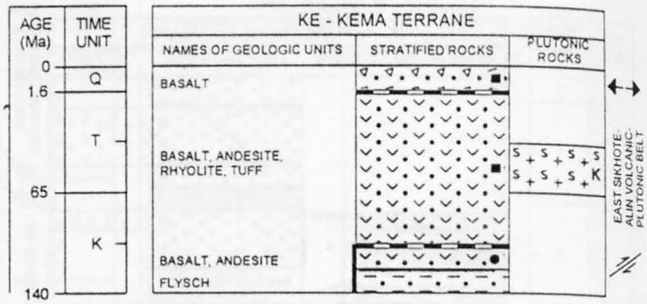

IG - INGALLS TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
Q
T
K
J
SOUTH PEAK UNIT
GABBRO, BASALT, ULTRAMAFIC ROCKS, SANDSTONE, SILTSTONE, CHERT


IK - IRUNEISKIY TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SILICEOUS SILTSTONE, MAFIC & INTERMEDIATE TUFF, BASALT, CHERT, JASPER, & AGGLOMERATE
BASE NOT EXPOSED
CENTRAL KAMCHATKA VOLCANIC BELT
KAMCHATKA KORAK VOLCANIC BELT
IRUNEY ISLAND ARC

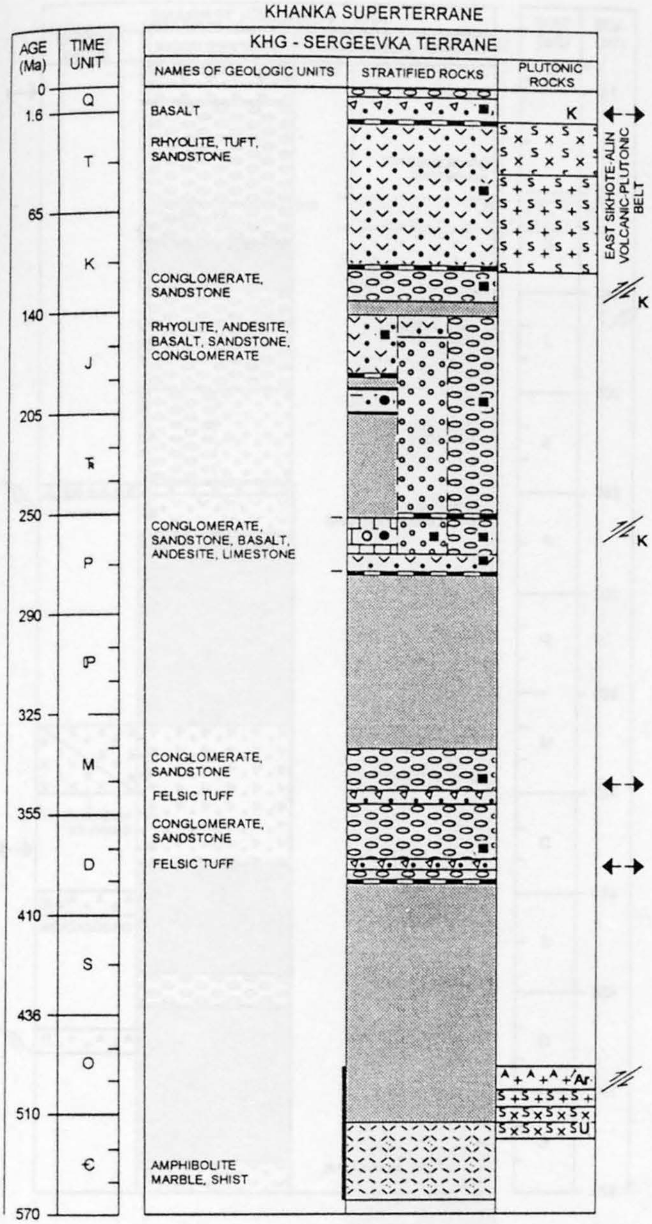

IZ - IZEE TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
COLUMBIA RIVER BASALT GROUP & STRAWBERRY VOLCANICS
JOHN DAY & CLARNO FMS.
BERNARD FORMATION
THROWBRIDGE, LONESOME, & SNOWSHOE FMS.
HYDE FM., MAURICH GP., KELLER CREEK SHALE, & MURDERERS CREEK, GRAYLOCK, & VESPER FMS.

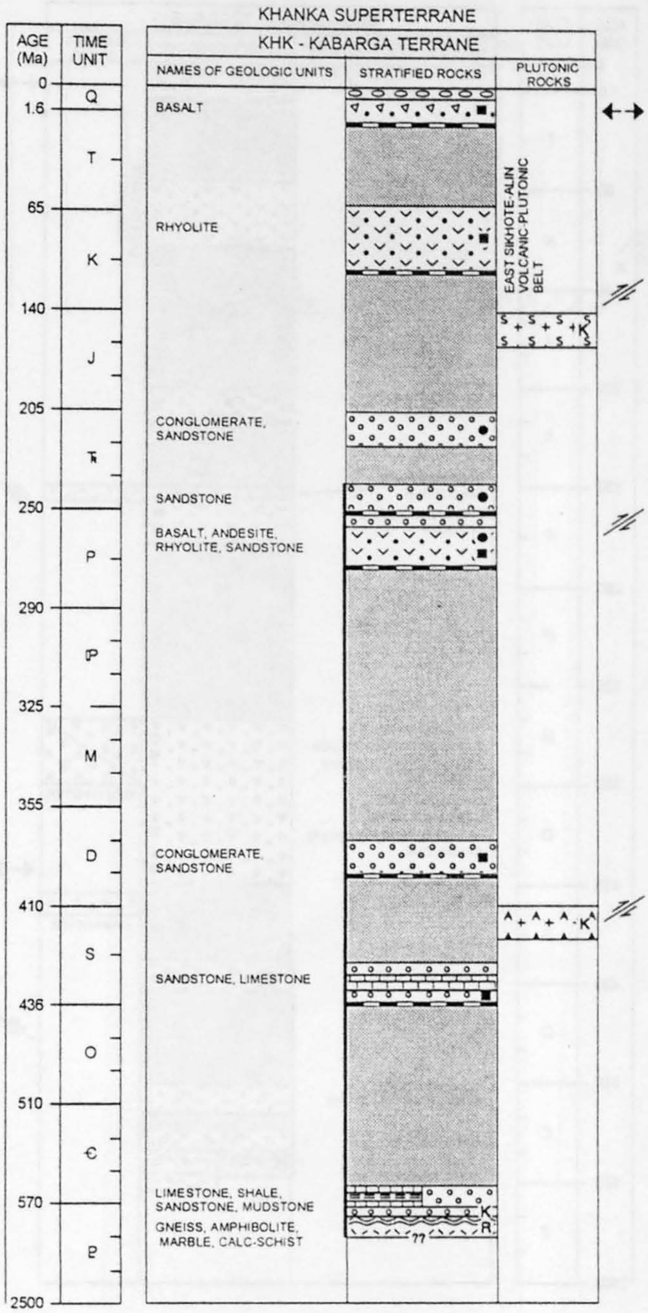


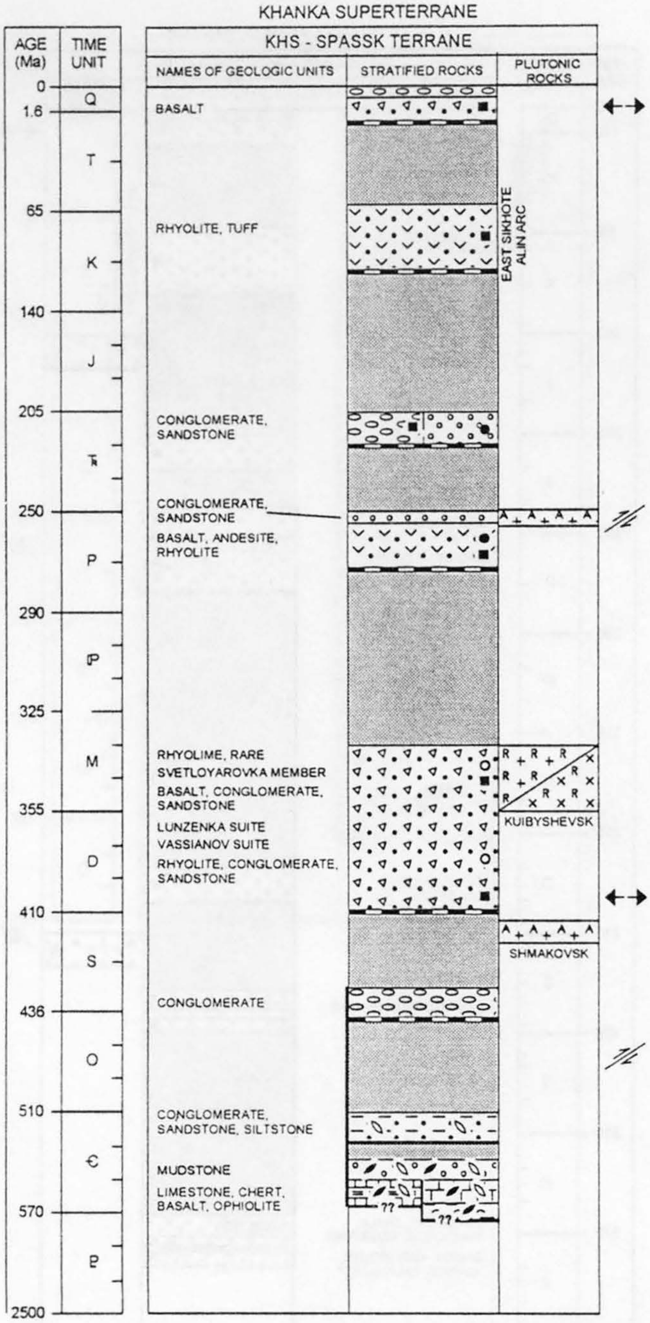
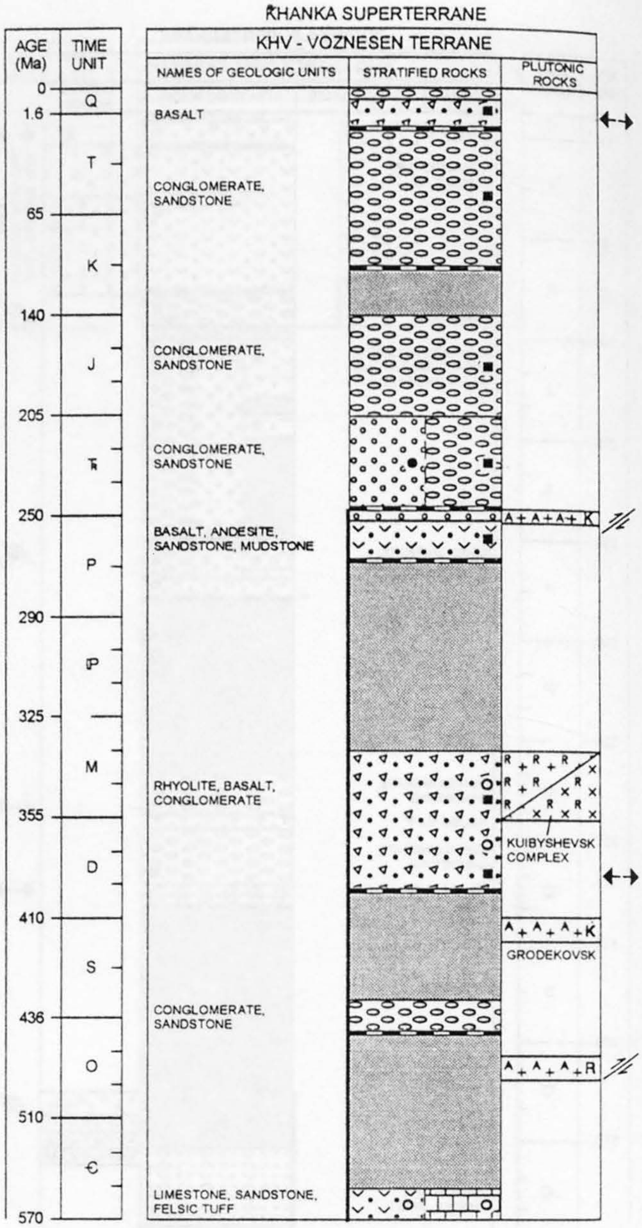
AGE (Ma)
TIME UNIT
KB - KHABAROVSK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
P
M
D
BASALT
CONGLOMERATE
SILTSTONE, SANDSTONE
SILICEOUS SHALE, BASALT, GABBRO
CHERT
LIMESTONE
SCHIST, METASANDSTONE
SAKHALIN-PRIMORYE VOLCANIC BELT

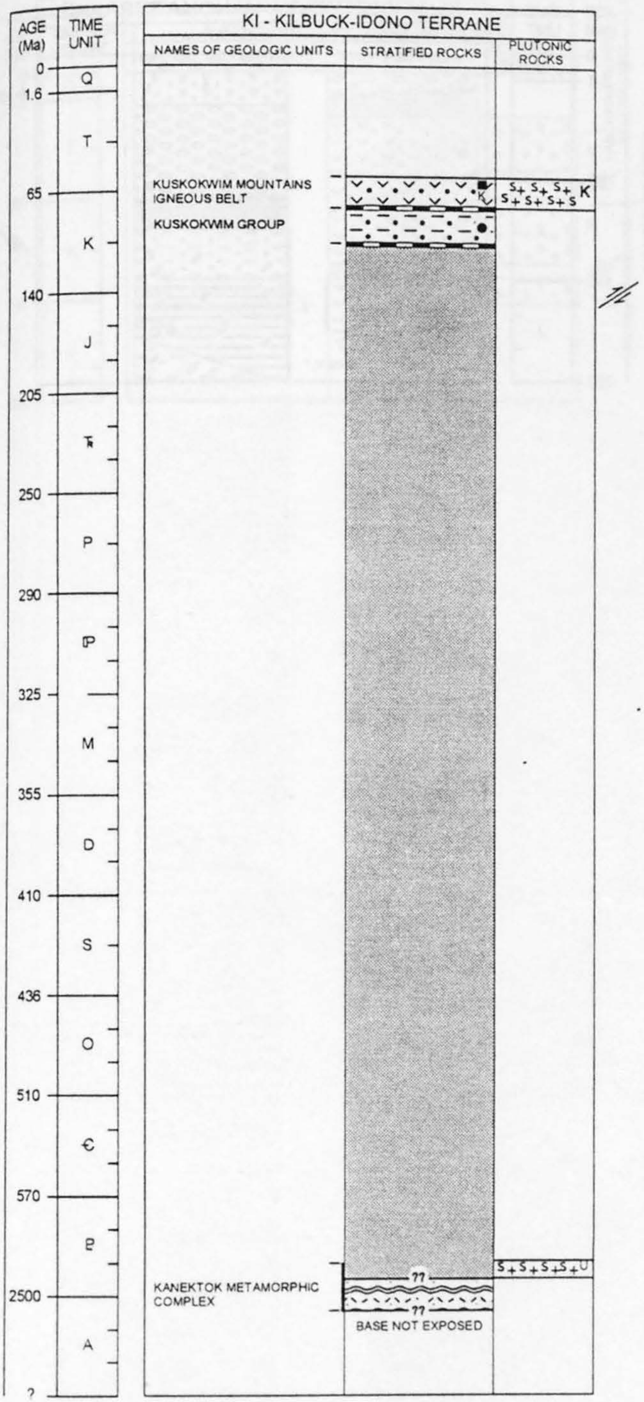


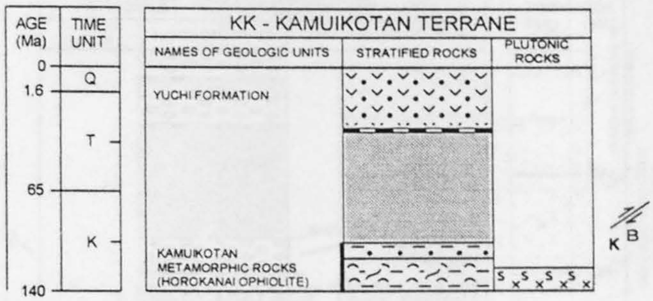
AGE (Ma)
TIME UNIT
KE - KEMA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
Q
T
K
BASALT
BASALT, ANDESITE, RHYOLITE, TUFF
BASALT, ANDESITE
FLYSCH
EAST SIKHOTE-ALIN VOLCANIC-PLUTONIC BELT

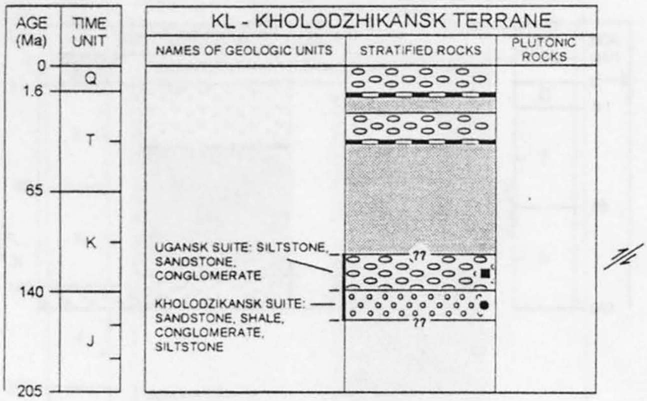

KHANKA SUPERTERRANE
KHG - SERGEEVKA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
Q
T
K
J
P
M
D
S
O
€
BASALT
RHYOLITE, TUFT, SANDSTONE
CONGLOMERATE, SANDSTONE
RHYOLITE, ANDESITE, BASALT, SANDSTONE, CONGLOMERATE
CONGLOMERATE, SANDSTONE, BASALT, ANDESITE, LIMESTONE
CONGLOMERATE, SANDSTONE
FELSIC TUFF
CONGLOMERATE, SANDSTONE
FELSIC TUFF
AMPHIBOLITE MARBLE, SHIST
EAST SIKHOTE-ALIN VOLCANIC-PLUTONIC BELT
K
Ar
U

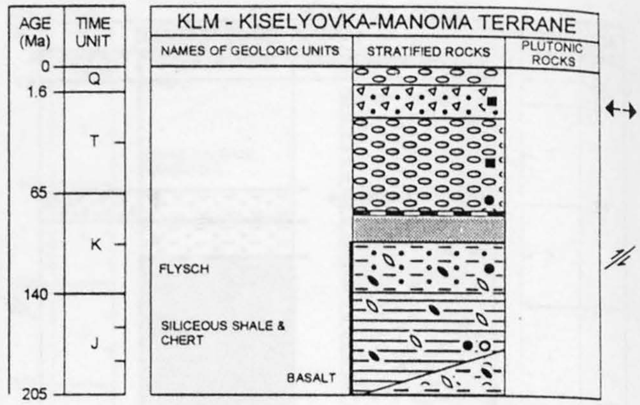

KHANKA SUPERTERRANE
KHK - KABARGA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
P
M
D
S
O
€
BASALT
RHYOLITE
CONGLOMERATE, SANDSTONE
SANDSTONE
BASALT, ANDESITE, RHYOLITE, SANDSTONE
CONGLOMERATE, SANDSTONE
SANDSTONE, LIMESTONE
LIMESTONE, SHALE, SANDSTONE, MUDSTONE
GNEISS, AMPHIBOLITE, MARBLE, CALC-SCHIST
EAST SIKHOTE-ALIN VOLCANIC-PLUTONIC BELT
K
R
??

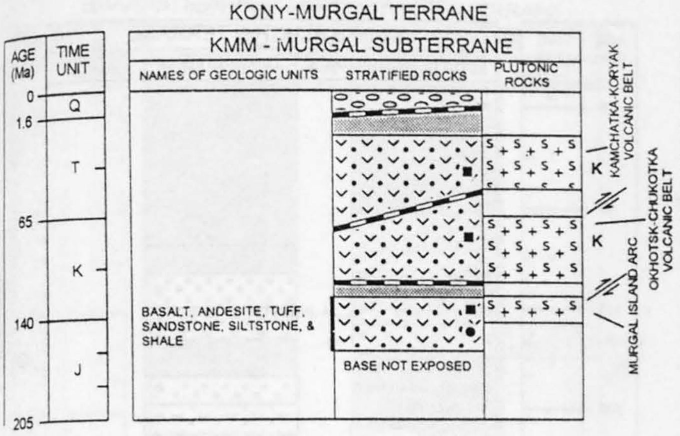

KHANKA SUPERTERRANE
KHS - SPASSK TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
M
D
S
O
P
BASALT
RHYOLITE, TUFF
EAST SIKHOTE ALIN ARC
CONGLOMERATE, SANDSTONE
CONGLOMERATE, SANDSTONE
BASALT, ANDESITE, RHYOLITE
RHYOLIME, RARE
SVETLOYAROVKA MEMBER
BASALT, CONGLOMERATE, SANDSTONE
LUNZENKA SUITE
VASSIANOV SUITE
RHYOLITE, CONGLOMERATE, SANDSTONE
KUIBYSHEVSK
SHMAKOVSK
CONGLOMERATE
CONGLOMERATE, SANDSTONE, SILTSTONE
MUDSTONE
LIMESTONE, CHERT, BASALT, OPHIOLITE

KHANKA SUPERTERRANE
KHV - VOZNESEN TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
Q
T
K
J
P
M
D
S
O
BASALT
CONGLOMERATE, SANDSTONE
CONGLOMERATE, SANDSTONE
CONGLOMERATE, SANDSTONE
BASALT, ANDESITE, SANDSTONE, MUDSTONE
RHYOLITE, BASALT, CONGLOMERATE
KUIBYSHEVSK COMPLEX
GRODEKOVSK
CONGLOMERATE, SANDSTONE
LIMESTONE, SANDSTONE, FELSIC TUFF

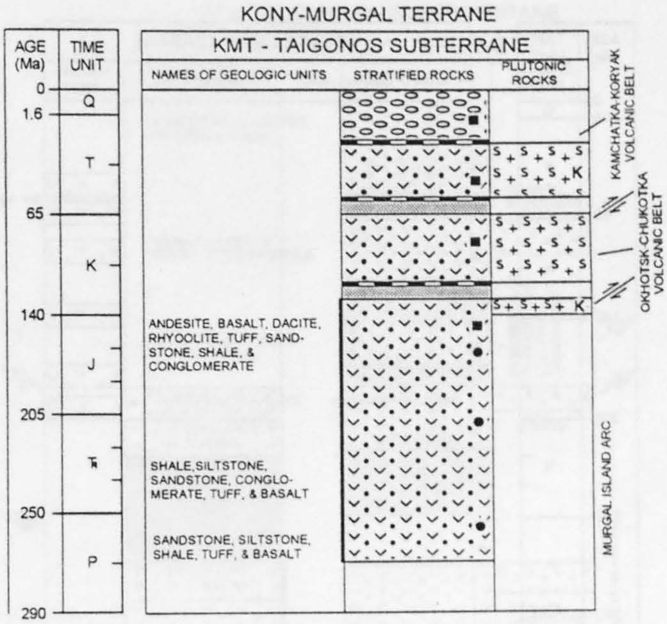

AGE (Ma)
TIME UNIT
KI - KILBUCK-IDONO TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
KUSKOKWIM MOUNTAINS IGNEOUS BELT
KUSKOKWIM GROUP
KANEKTOK METAMORPHIC COMPLEX
BASE NOT EXPOSED

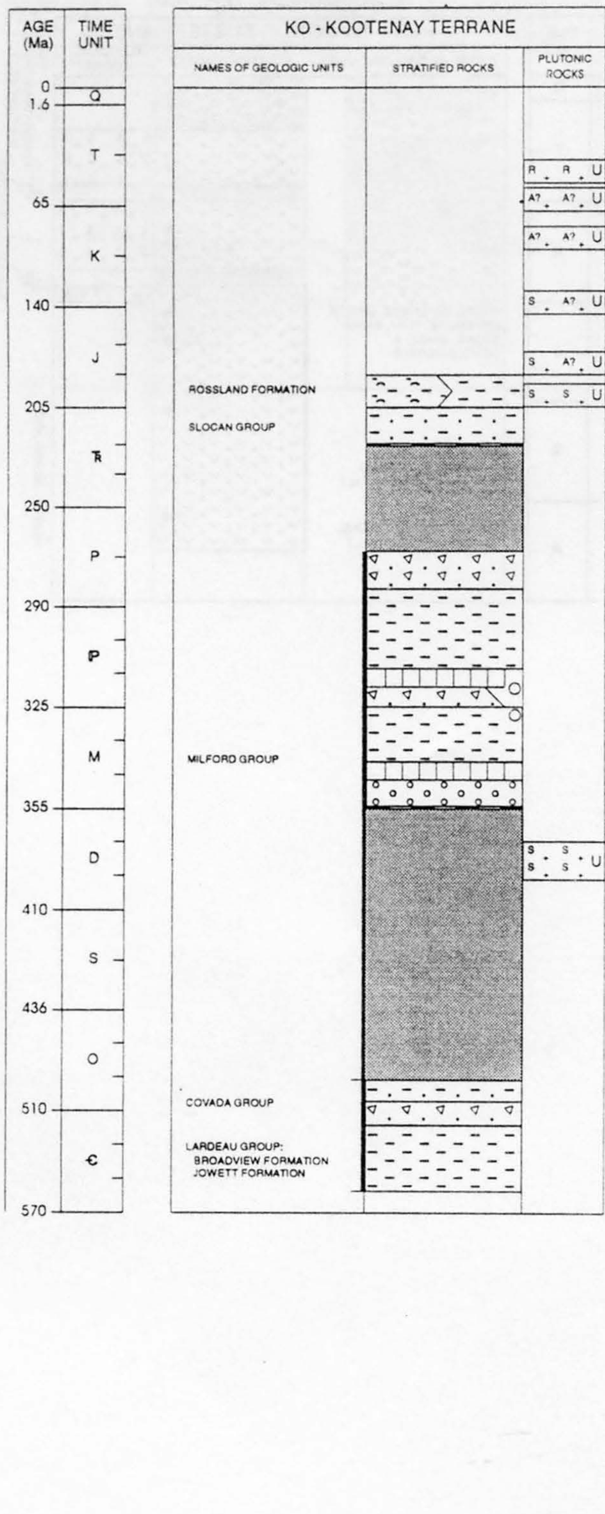

AGE (Ma)
TIME UNIT
KK - KAMUIKOTAN TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
YUCHI FORMATION
KAMUIKOTAN METAMORPHIC ROCKS (HOROKANAI OPHIOLITE)

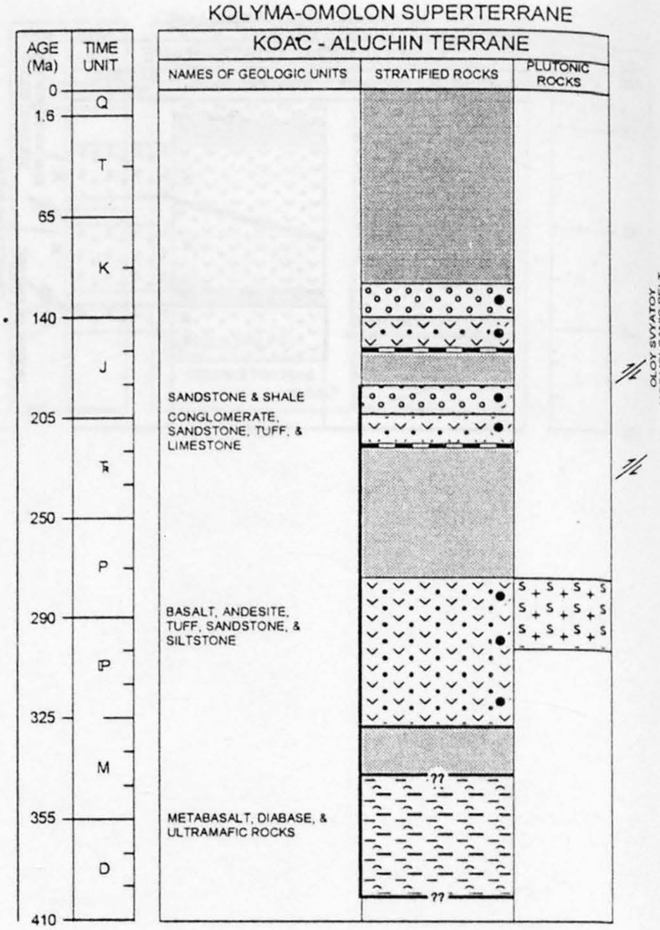

AGE (Ma)
TIME UNIT
KL - KHOLODZHIKANSK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
UGANSK SUITE: SILTSTONE, SANDSTONE, CONGLOMERATE
KHOLODZIKANSK SUITE: SANDSTONE, SHALE, CONGLOMERATE, SILTSTONE
??

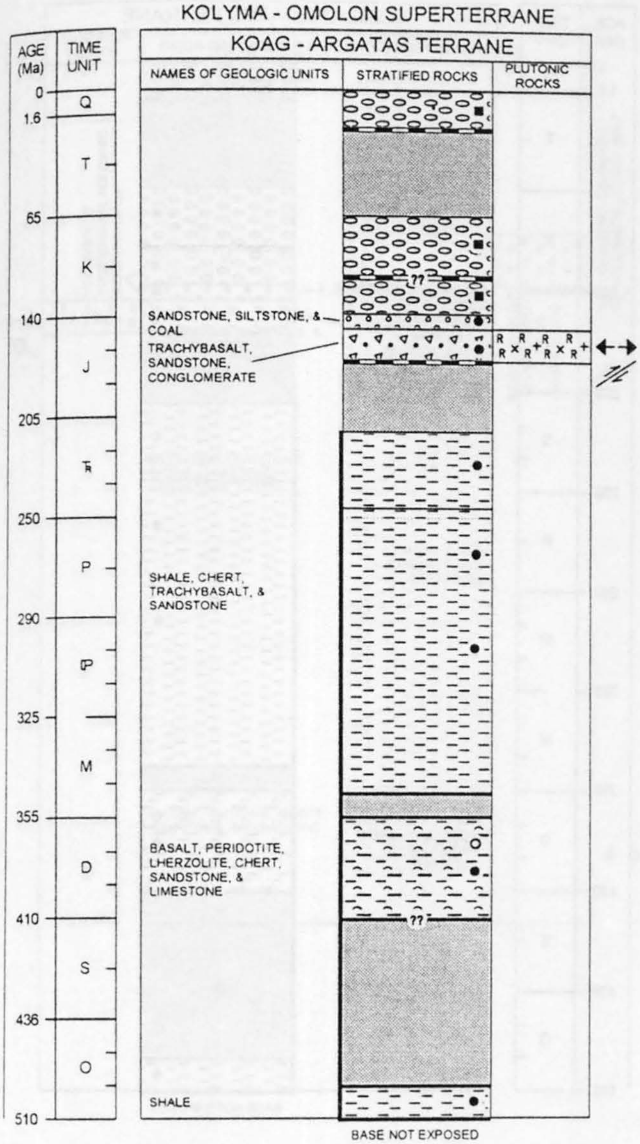

AGE (Ma)
TIME UNIT
KLM - KISELYOVKA-MANOMA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
FLYSCH
SILICEOUS SHALE & CHERT
BASALT

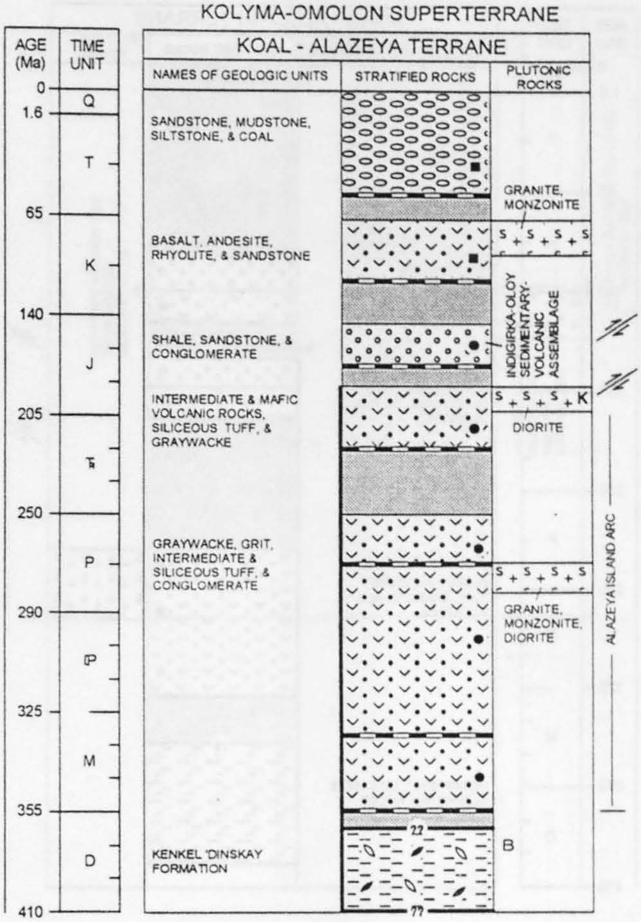

KONY-MURGAL TERRANE
KMM - MURGAL SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
Q
T
K
J
BASALT, ANDESITE, TUFF, SANDSTONE, SILTSTONE, & SHALE
BASE NOT EXPOSED
KAMCHATKA-KORYAK VOLCANIC BELT
OKHOTSK-CHUKOTKA VOLCANIC BELT
MURGAL ISLAND ARC

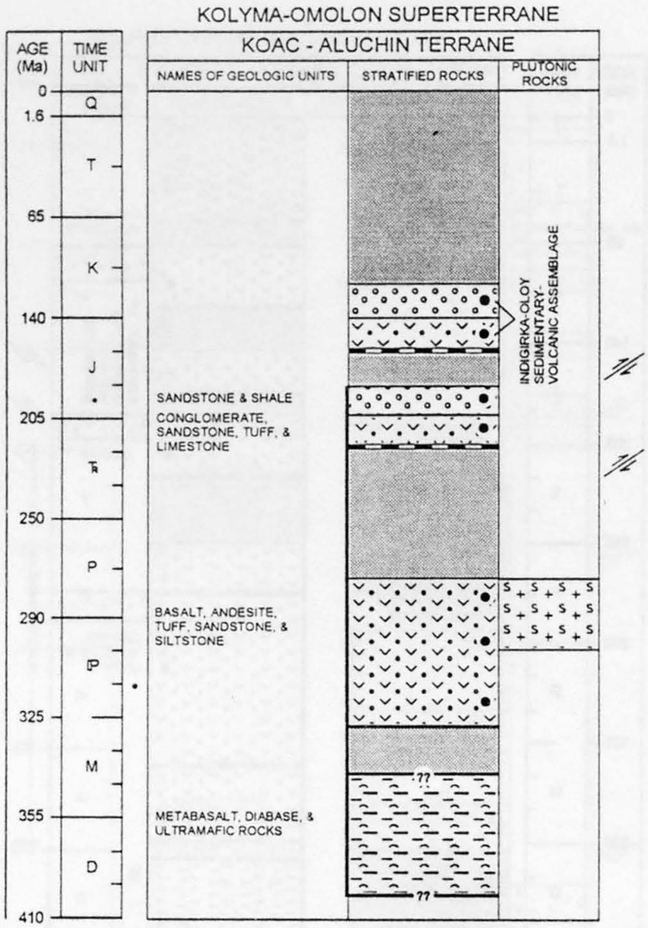

KONY-MURGAL TERRANE
KMT - TAIGONOS SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
Q
T
K
J
Ћ
P
ANDESITE, BASALT, DACITE, RHYOOLITE, TUFF, SANDSTONE, SHALE, & CONGLOMERATE
SHALE, SILTSTONE, SANDSTONE, CONGLOMERATE, TUFF, & BASALT
SANDSTONE, SILTSTONE, SHALE, TUFF, & BASALT
KAMCHATKA-KORYAK VOLCANIC BELT
OKHOTSK-CHUKOTKA VOLCANIC BELT
MURGAL ISLAND ARC

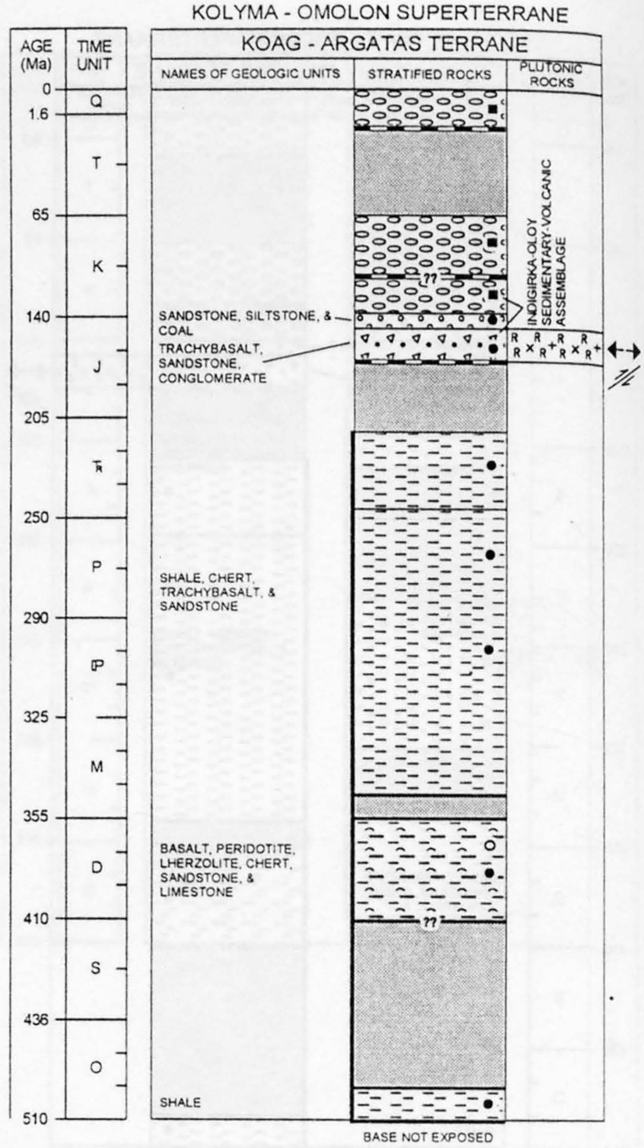

AGE (Ma)
TIME UNIT
KO - KOOTENAY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
Q
T
K
J
Ꞧ
P
ⱣP
M
D
S
O
Є
ROSSLAND FORMATION
SLOCAN GROUP
MILFORD GROUP
COVADA GROUP
LARDEAU GROUP:
BROADVIEW FORMATION
JOWETT FORMATION

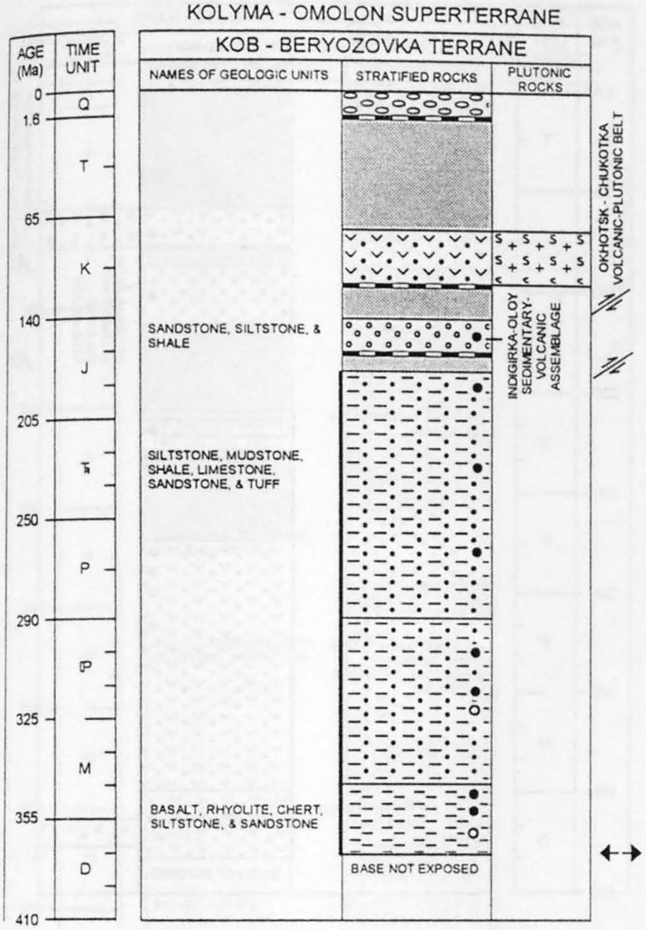

KOLYMA-OMOLON SUPERTERRANE
KOAC - ALUCHIN TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
Ꞧ
P
ⱣP
M
D
SANDSTONE & SHALE
CONGLOMERATE, SANDSTONE, TUFF, & LIMESTONE
BASALT, ANDESITE, TUFF, SANDSTONE, & SILTSTONE
METABASALT, DIABASE, & ULTRAMAFIC ROCKS
OLOY SVYATOY NOS VOLCANIC BELT

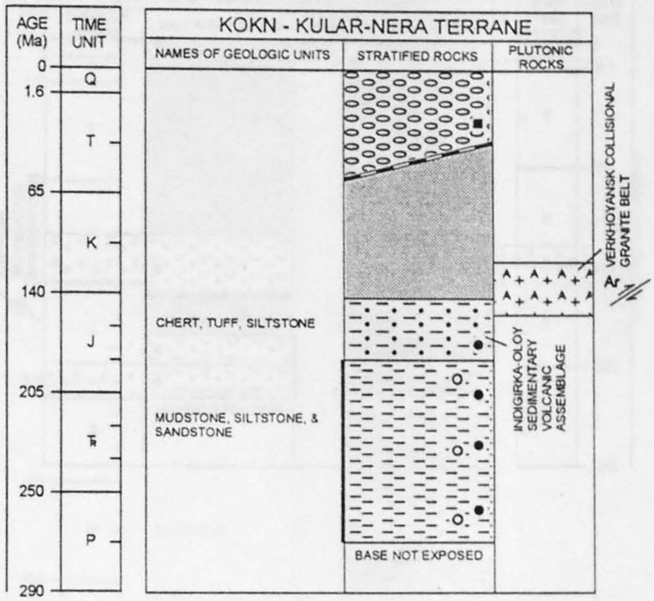

KOLYMA - OMOLON SUPERTERRANE
KOAG - ARGATAS TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SANDSTONE, SILTSTONE, & COAL
TRACHYBASALT, SANDSTONE, CONGLOMERATE
SHALE, CHERT, TRACHYBASALT, & SANDSTONE
BASALT, PERIDOTITE, LHERZOLITE, CHERT, SANDSTONE, & LIMESTONE
SHALE
BASE NOT EXPOSED

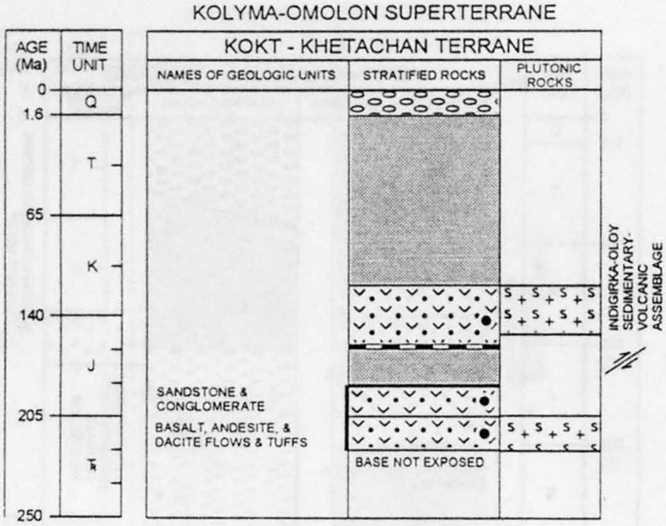

KOLYMA-OMOLON SUPERTERRANE
KOAL - ALAZEYA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SANDSTONE, MUDSTONE, SILTSTONE, & COAL
BASALT, ANDESITE, RHYOLITE, & SANDSTONE
SHALE, SANDSTONE, & CONGLOMERATE
INTERMEDIATE & MAFIC VOLCANIC ROCKS, SILICEOUS TUFF, & GRAYWACKE
GRAYWACKE, GRIT, INTERMEDIATE & SILICEOUS TUFF, & CONGLOMERATE
KENKEL 'DINSKAY FORMATION
GRANITE, MONZONITE
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE
DIORITE
GRANITE, MONZONITE, DIORITE
ALAZEYA ISLAND ARC

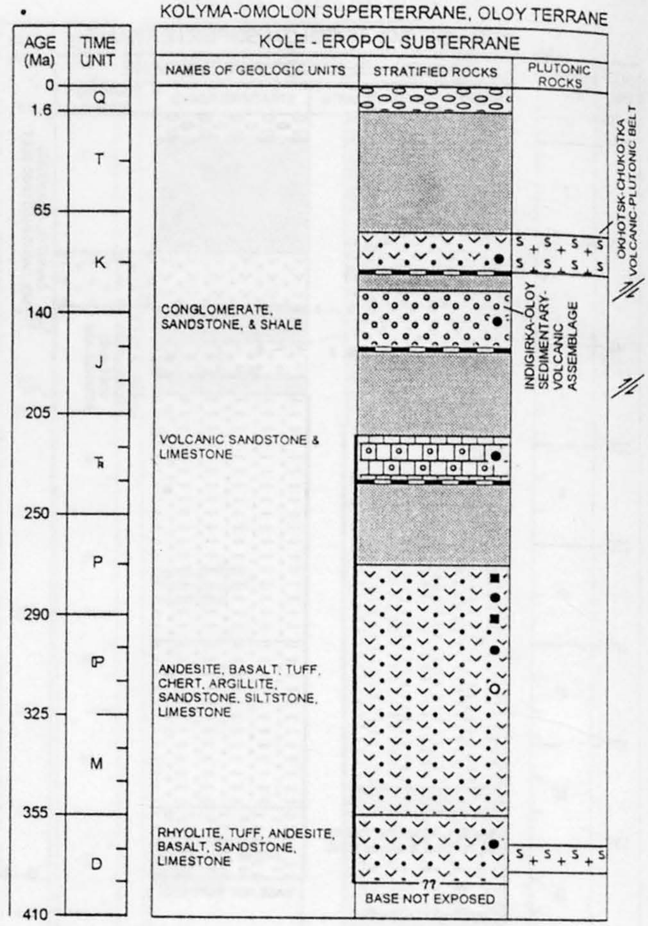

KOLYMA-OMOLON SUPERTERRANE
KOAC - ALUCHIN TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE
SANDSTONE & SHALE
CONGLOMERATE, SANDSTONE, TUFF, & LIMESTONE
BASALT, ANDESITE, TUFF, SANDSTONE, & SILTSTONE
METABASALT, DIABASE, & ULTRAMAFIC ROCKS

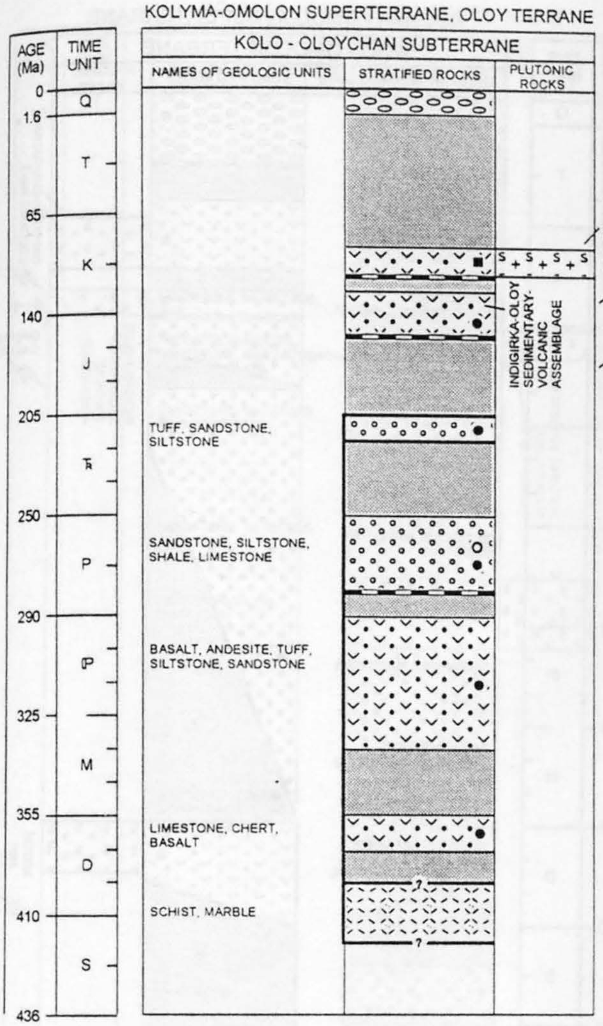

KOLYMA - OMOLON SUPERTERRANE
KOAG - ARGATAS TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE
SANDSTONE, SILTSTONE, & COAL
TRACHYBASALT, SANDSTONE, CONGLOMERATE
SHALE, CHERT, TRACHYBASALT, & SANDSTONE
BASALT, PERIDOTITE, LHERZOLITE, CHERT, SANDSTONE, & LIMESTONE
SHALE
BASE NOT EXPOSED

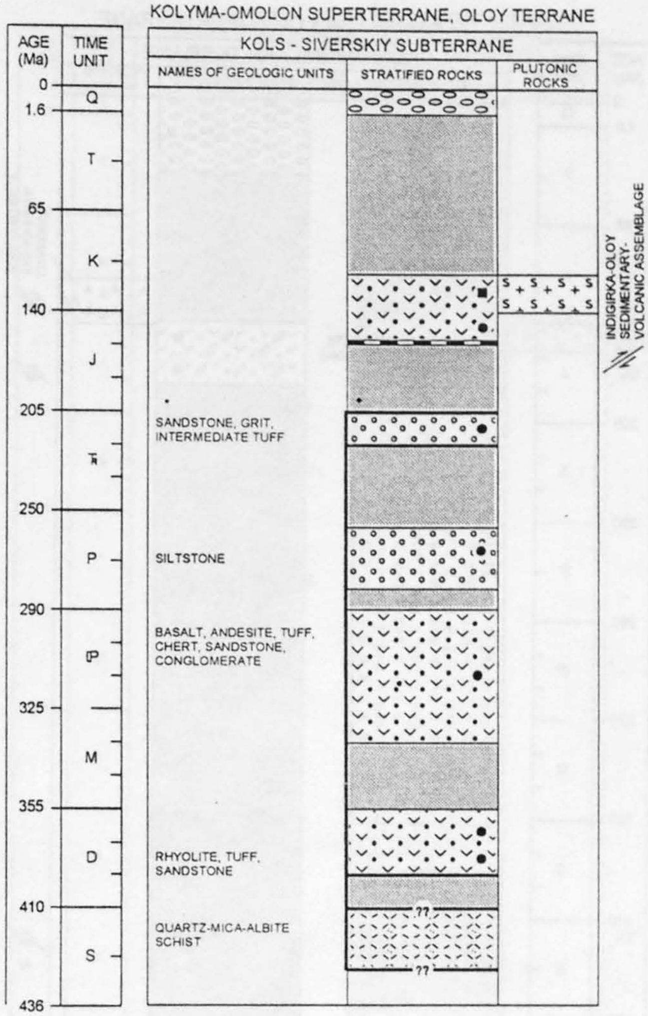

KOLYMA - OMOLON SUPERTERRANE
KOB - BERYOZOVKA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SANDSTONE, SILTSTONE, & SHALE
SILTSTONE, MUDSTONE, SHALE, LIMESTONE, SANDSTONE, & TUFF
BASALT, RHYOLITE, CHERT, SILTSTONE, & SANDSTONE
BASE NOT EXPOSED
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE
OKHOTSK - CHUKOTKA VOLCANIC-PLUTONIC BELT

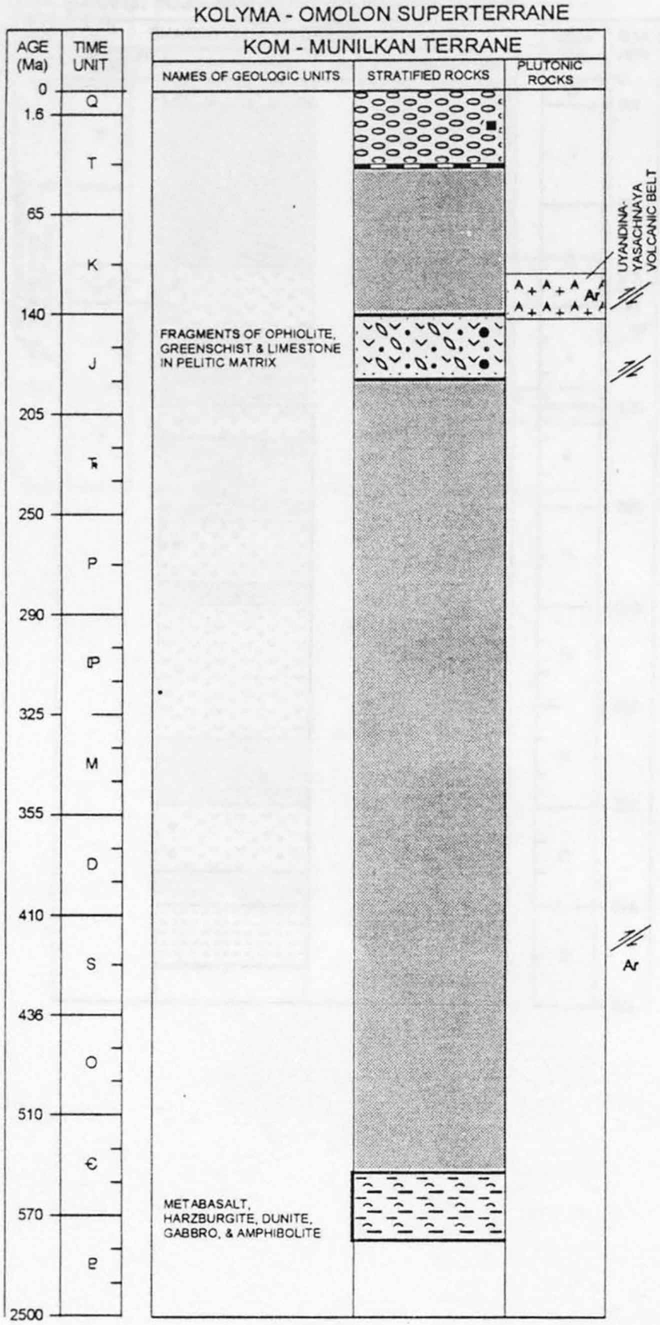

KOKN - KULAR-NERA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
CHERT, TUFF, SILTSTONE
MUDSTONE, SILTSTONE, & SANDSTONE
BASE NOT EXPOSED
INDIGIRKA-OLOY SEDIMENTARY VOLCANIC ASSEMBLAGE
VERKHOYANSK COLLISIONAL GRANITE BELT
Ar

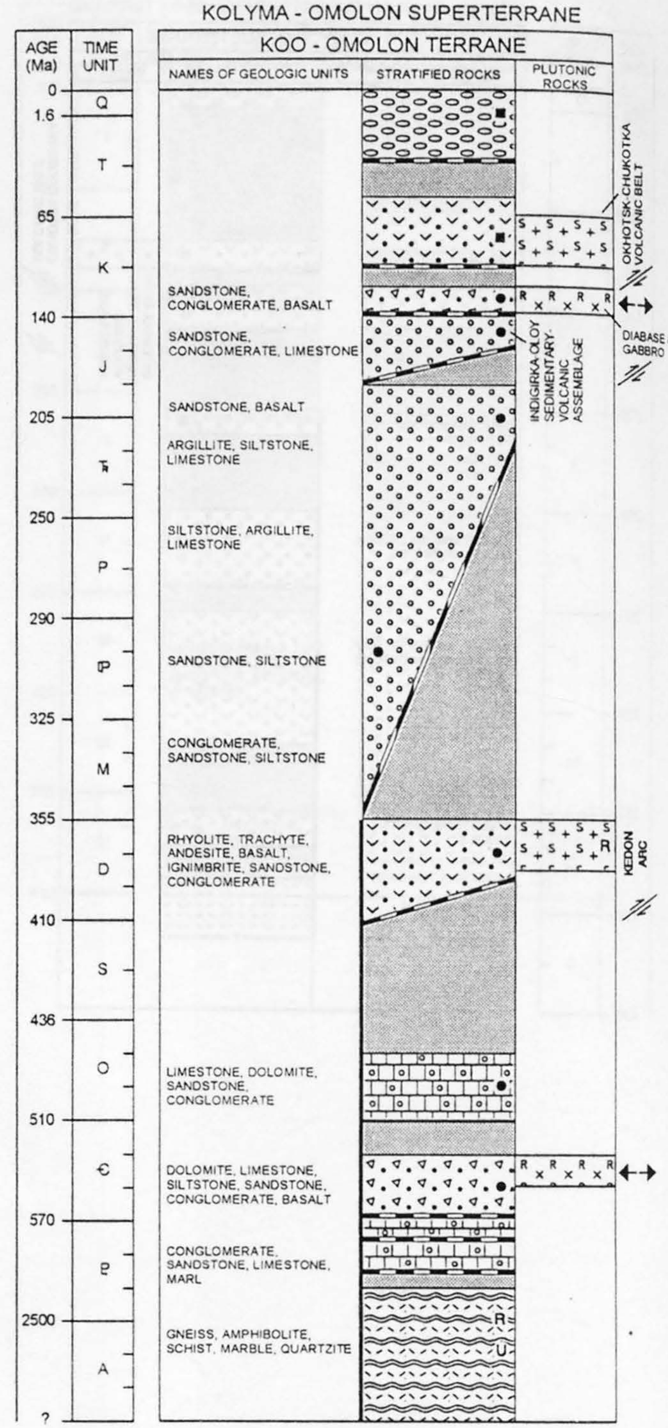

KOLYMA-OMOLON SUPERTERRANE
AGE (Ma)
TIME UNIT
KOKT - KHETACHAN TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
Ŧ
SANDSTONE & CONGLOMERATE
BASALT, ANDESITE, & DACITE FLOWS & TUFFS
BASE NOT EXPOSED
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE

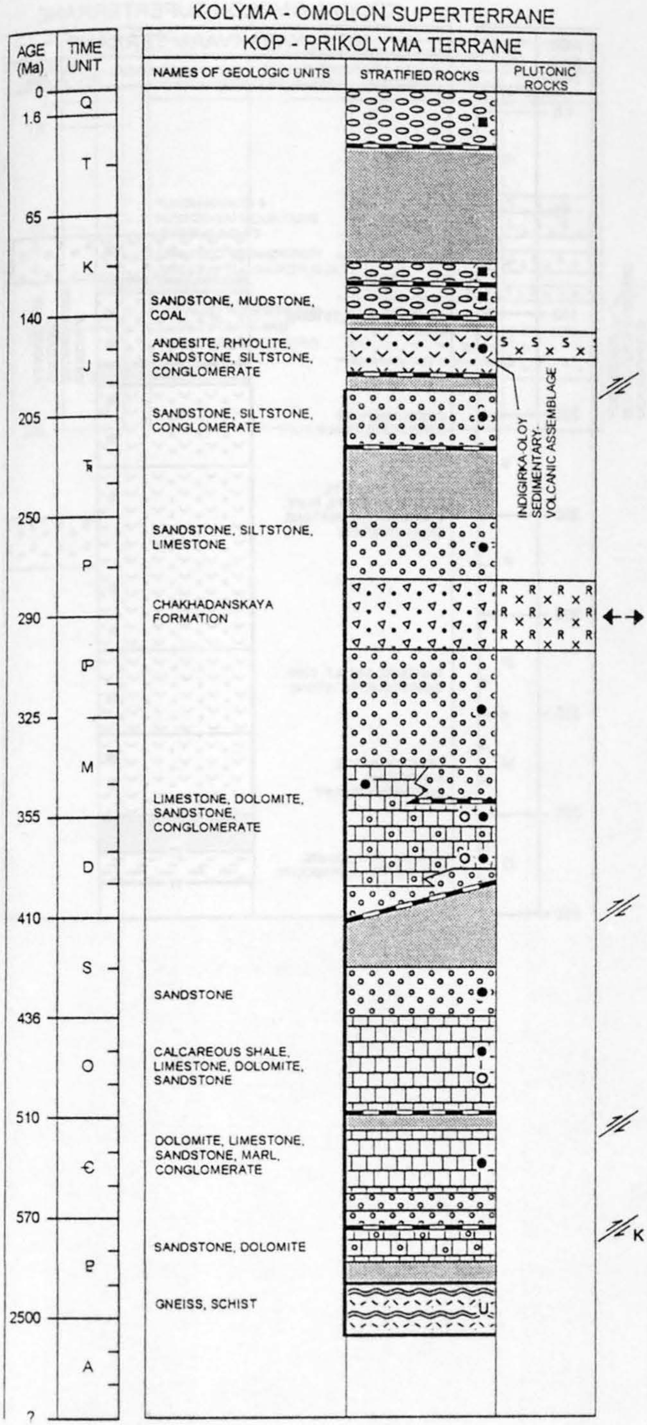

KOLYMA-OMOLON SUPERTERRANE, OLOY TERRANE
AGE (Ma)
TIME UNIT
KOLE - EROPOL SUBTERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
Ŧ
P
IP
M
D
CONGLOMERATE, SANDSTONE, & SHALE
VOLCANIC SANDSTONE & LIMESTONE
ANDESITE, BASALT, TUFF, CHERT, ARGILLITE, SANDSTONE, SILTSTONE, LIMESTONE
RHYOLITE, TUFF, ANDESITE, BASALT, SANDSTONE, LIMESTONE
BASE NOT EXPOSED
OKHOTSK-CHUKOTKA VOLCANIC-PLUTONIC BELT
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE

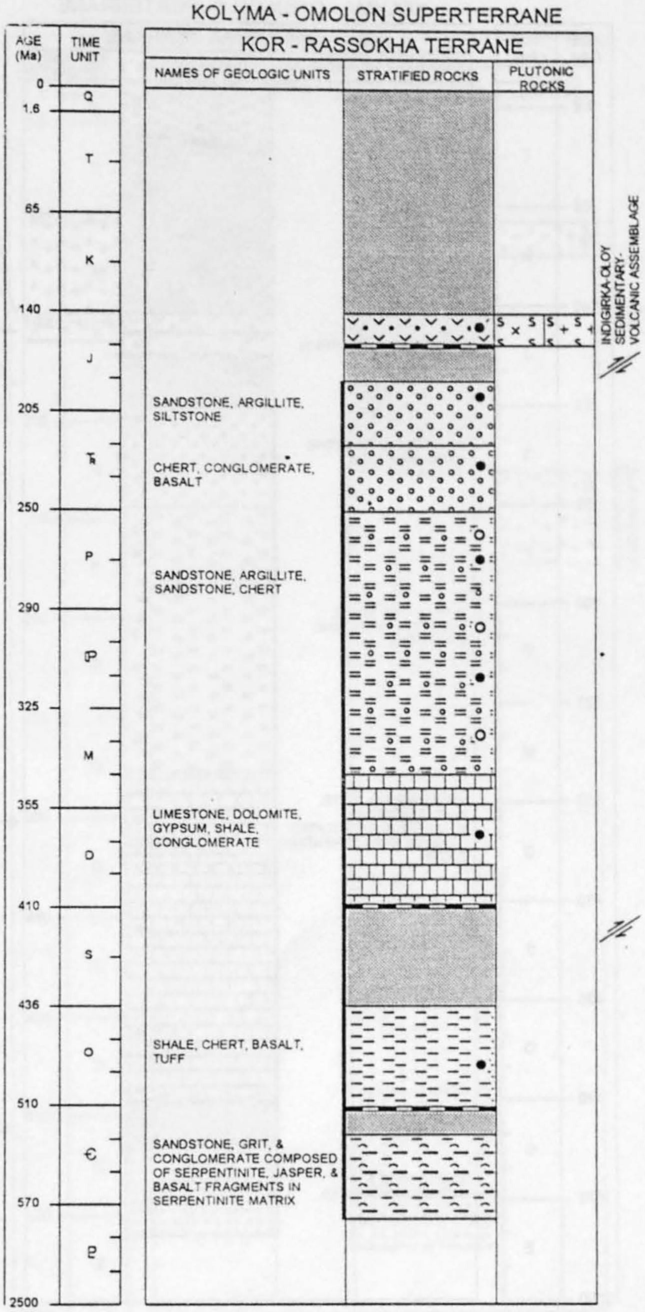

KOLYMA-OMOLON SUPERTERRANE, OLOY TERRANE
KOLO - OLOYCHAN SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
Q
T
K
J
P
M
D
S
TUFF, SANDSTONE, SILTSTONE
SANDSTONE, SILTSTONE, SHALE, LIMESTONE
BASALT, ANDESITE, TUFF, SILTSTONE, SANDSTONE
LIMESTONE, CHERT, BASALT
SCHIST, MARBLE
OKHOTSK-CHUKOTKA VOLCANIC BELT
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE

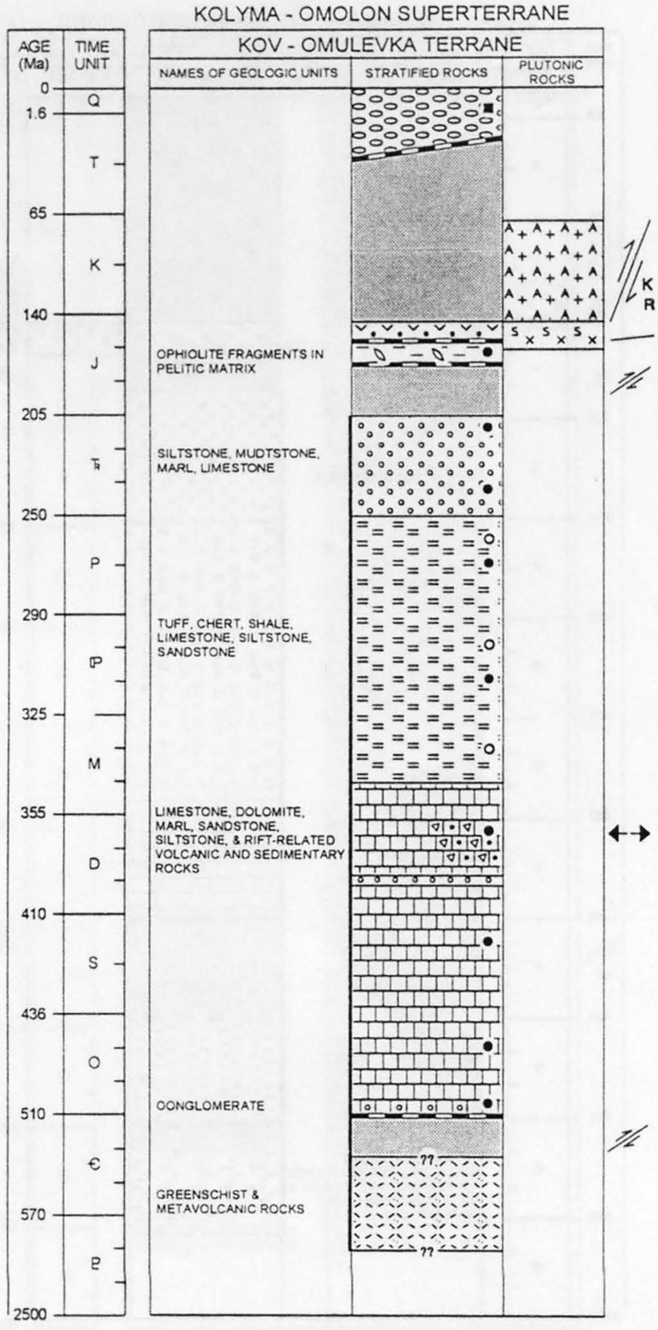

KOLYMA-OMOLON SUPERTERRANE, OLOY TERRANE
KOLS - SIVERSKIY SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
Q
T
K
J
P
M
D
S
SANDSTONE, GRIT, INTERMEDIATE TUFF
SILTSTONE
BASALT, ANDESITE, TUFF, CHERT, SANDSTONE, CONGLOMERATE
RHYOLITE, TUFF, SANDSTONE
QUARTZ-MICA-ALBITE SCHIST
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE

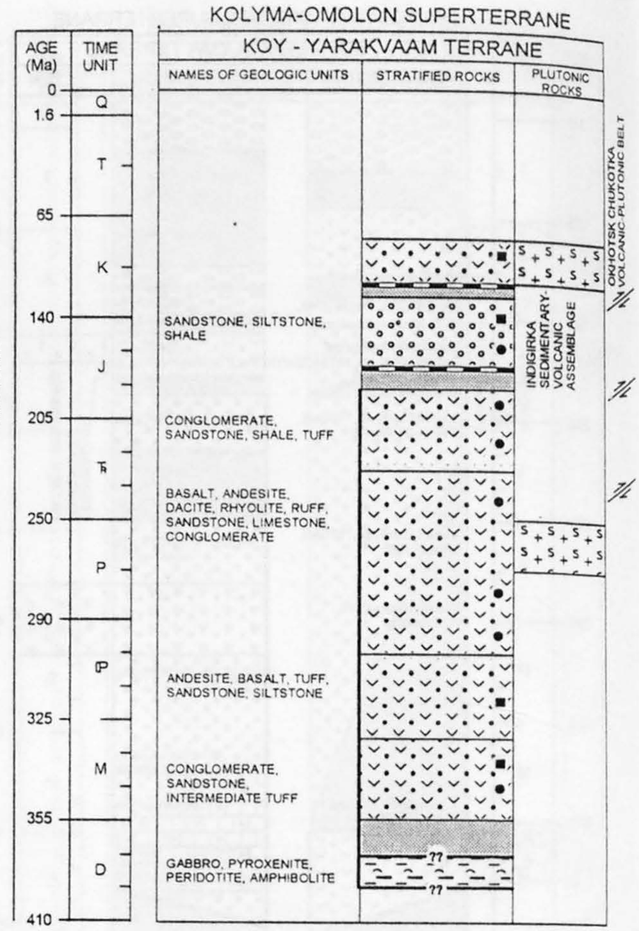

KOLYMA - OMOLON SUPERTERRANE
KOM - MUNILKAN TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
P
M
D
S
O
UYANDINA-YASACHNAYA VOLCANIC BELT
Ar
FRAGMENTS OF OPHIOLITE, GREENSCHIST & LIMESTONE IN PELITIC MATRIX
METABASALT, HARZBURGITE, DUNITE, GABBRO, & AMPHIBOLITE

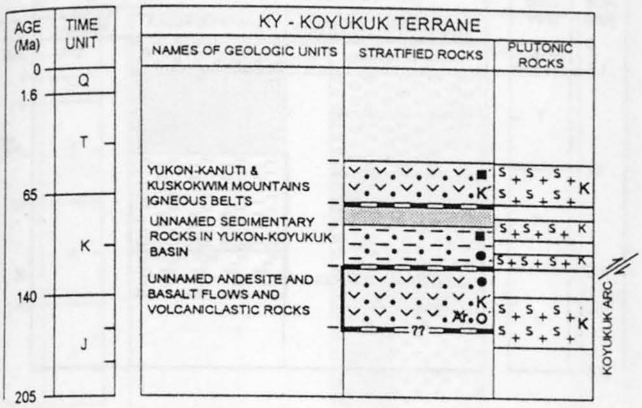

KOLYMA - OMOLON SUPERTERRANE
KOO - OMOLON TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
P
M
D
S
O
A
OKHOTSK-CHUKOTKA VOLCANIC BELT
SANDSTONE, CONGLOMERATE, BASALT
SANDSTONE, CONGLOMERATE, LIMESTONE
DIABASE & GABBRO
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE
SANDSTONE, BASALT
ARGILLITE, SILTSTONE, LIMESTONE
SILTSTONE, ARGILLITE, LIMESTONE
SANDSTONE, SILTSTONE
CONGLOMERATE, SANDSTONE, SILTSTONE
RHYOLITE, TRACHYTE, ANDESITE, BASALT, IGNIMBRITE, SANDSTONE, CONGLOMERATE
KEDON ARC
LIMESTONE, DOLOMITE, SANDSTONE, CONGLOMERATE
DOLOMITE, LIMESTONE, SILTSTONE, SANDSTONE, CONGLOMERATE, BASALT
CONGLOMERATE, SANDSTONE, LIMESTONE, MARL
GNEISS, AMPHIBOLITE, SCHIST, MARBLE, QUARTZITE

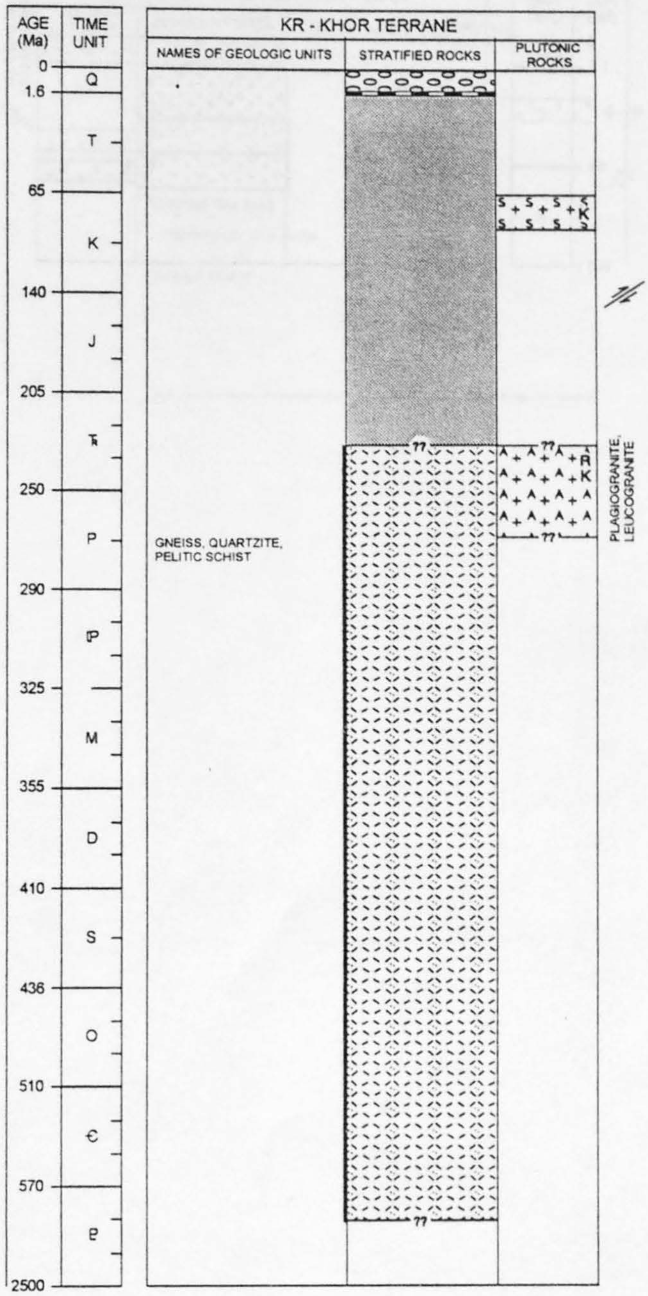

KOLYMA - OMOLON SUPERTERRANE
KOP - PRIKOLYMA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
Ћ
P
Ҏ
M
D
S
O
Є
Ɐ
A
SANDSTONE, MUDSTONE, COAL
ANDESITE, RHYOLITE, SANDSTONE, SILTSTONE, CONGLOMERATE
SANDSTONE, SILTSTONE, CONGLOMERATE
SANDSTONE, SILTSTONE, LIMESTONE
CHAKHADANSKAYA FORMATION
LIMESTONE, DOLOMITE, SANDSTONE, CONGLOMERATE
SANDSTONE
CALCAREOUS SHALE, LIMESTONE, DOLOMITE, SANDSTONE
DOLOMITE, LIMESTONE, SANDSTONE, MARL, CONGLOMERATE
SANDSTONE, DOLOMITE
GNEISS, SCHIST
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE
K

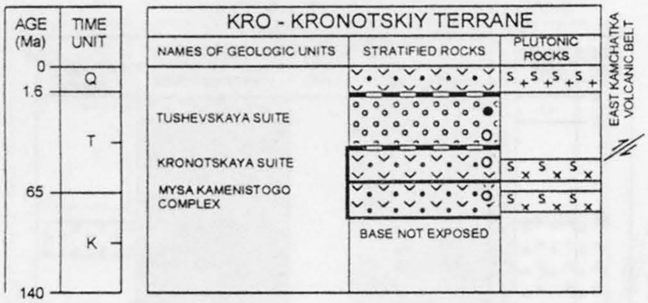

KOLYMA - OMOLON SUPERTERRANE
KOR - RASSOKHA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
Ћ
P
Ҏ
M
D
S
O
Є
Ɐ
SANDSTONE, ARGILLITE, SILTSTONE
CHERT, CONGLOMERATE, BASALT
SANDSTONE, ARGILLITE, SANDSTONE, CHERT
LIMESTONE, DOLOMITE, GYPSUM, SHALE, CONGLOMERATE
SHALE, CHERT, BASALT, TUFF
SANDSTONE, GRIT, & CONGLOMERATE COMPOSED OF SERPENTINITE, JASPER, & BASALT FRAGMENTS IN SERPENTINITE MATRIX
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE

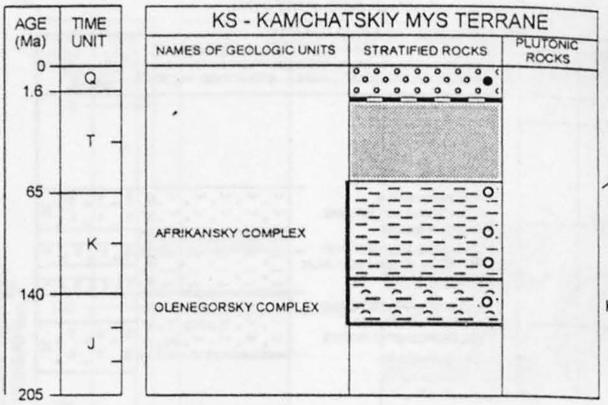

KOLYMA - OMOLON SUPERTERRANE
KOV - OMULEVKA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
Ŧ
P
ℙ
M
D
S
O
€
Ᵽ
OPHIOLITE FRAGMENTS IN PELITIC MATRIX
SILTSTONE, MUDTSTONE, MARL, LIMESTONE
TUFF, CHERT, SHALE, LIMESTONE, SILTSTONE, SANDSTONE
LIMESTONE, DOLOMITE, MARL, SANDSTONE, SILTSTONE, & RIFT-RELATED VOLCANIC AND SEDIMENTARY ROCKS
CONGLOMERATE
GREENSCHIST & METAVOLCANIC ROCKS
K
R
INDIGIRKA-OLOY SEDIMENTARY-VOLCANIC ASSEMBLAGE
??

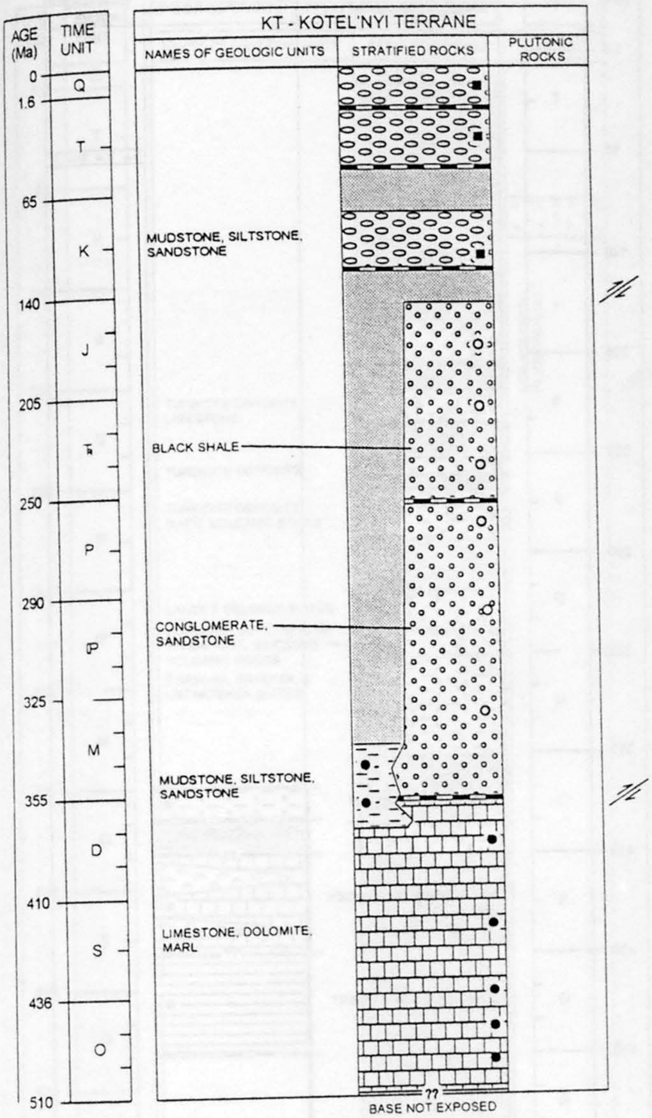

KOLYMA-OMOLON SUPERTERRANE
KOY - YARAKVAAM TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
Ŧ
P
ℙ
M
D
SANDSTONE, SILTSTONE, SHALE
CONGLOMERATE, SANDSTONE, SHALE, TUFF
BASALT, ANDESITE, DACITE, RHYOLITE, RUFF, SANDSTONE, LIMESTONE, CONGLOMERATE
ANDESITE, BASALT, TUFF, SANDSTONE, SILTSTONE
CONGLOMERATE, SANDSTONE, INTERMEDIATE TUFF
GABBRO, PYROXENITE, PERIDOTITE, AMPHIBOLITE
OKHOTSK CHUKOTKA VOLCANIC PLUTONIC BELT
INDIGIRKA SEDIMENTARY-VOLCANIC ASSEMBLAGE
??


AGE (Ma)
TIME UNIT
KY - KOYUKUK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
Q
T
K
J
YUKON-KANUTI & KUSKOKWIM MOUNTAINS IGNEOUS BELTS
UNNAMED SEDIMENTARY ROCKS IN YUKON-KOYUKUK BASIN
UNNAMED ANDESITE AND BASALT FLOWS AND VOLCANICLASTIC ROCKS
KOYUKUK ARC

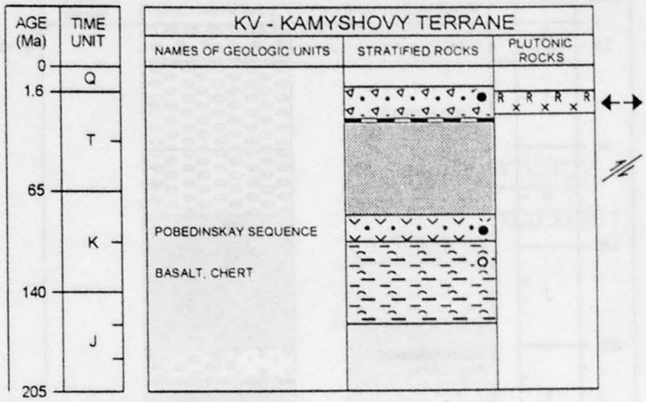

AGE (Ma)
TIME UNIT
KR - KHOR TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
Ћ
P
IP
M
D
S
O
Є
P
GNEISS, QUARTZITE, PELITIC SCHIST
PLAGIOGRANITE, LEUCOGRANITE


AGE (Ma)
TIME UNIT
KRO - KRONOTSKIY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
EAST KAMCHATKA VOLCANIC BELT
0
1.6
65
140
Q
T
K
TUSHEVSKAYA SUITE
KRONOTSKAYA SUITE
MYSA KAMENISTOGO COMPLEX
BASE NOT EXPOSED

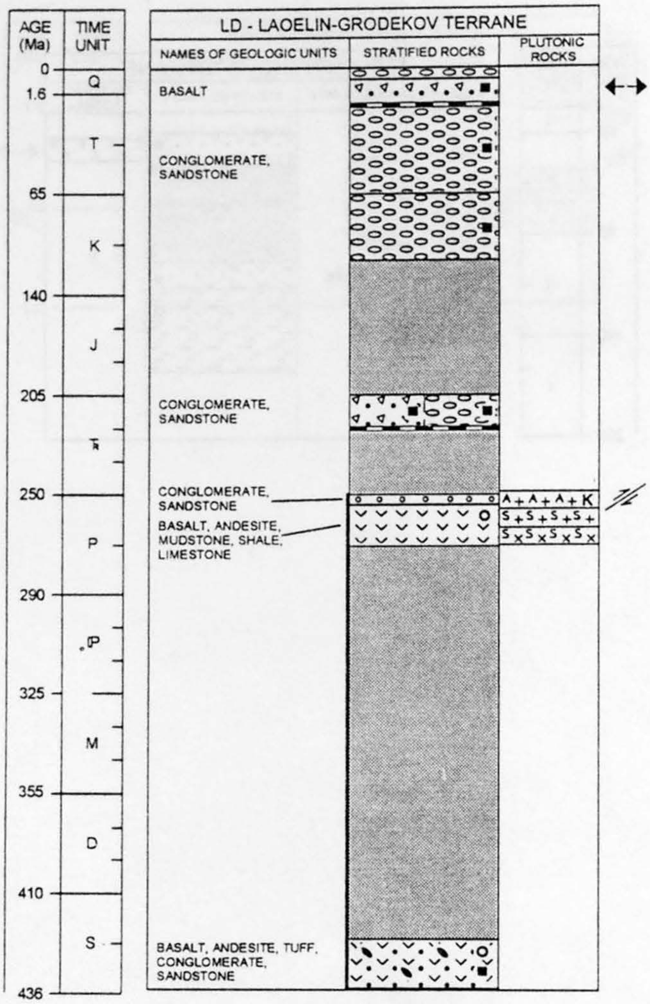

AGE (Ma)
TIME UNIT
KS - KAMCHATSKIY MYS TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
Q
T
K
J
AFRIKANSKY COMPLEX
OLENEGORSKY COMPLEX
K

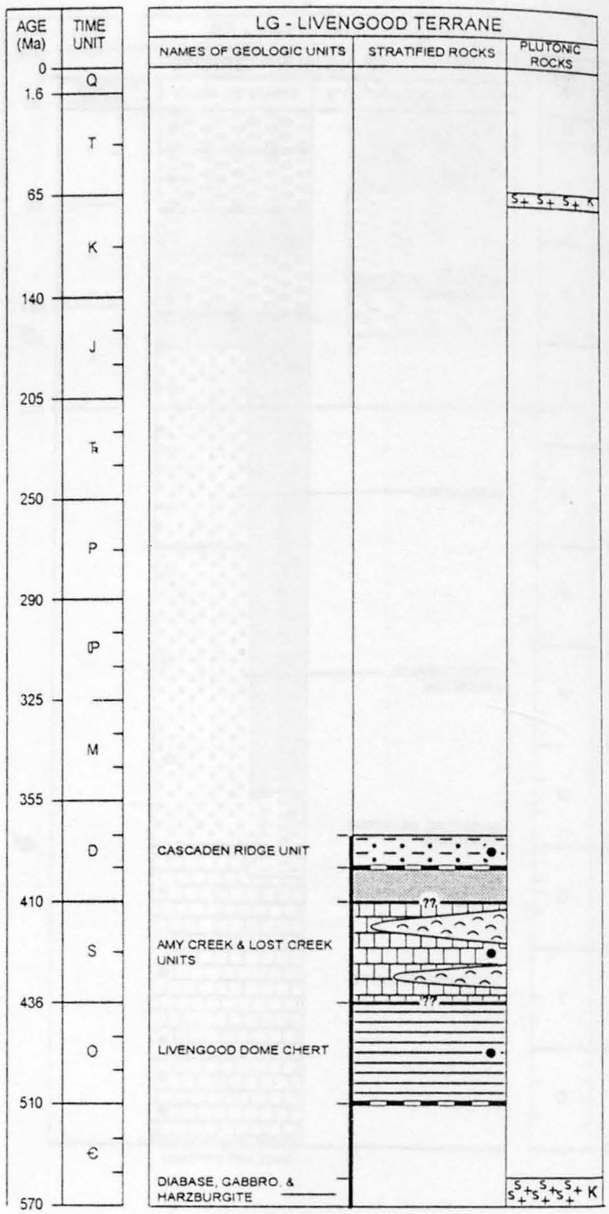


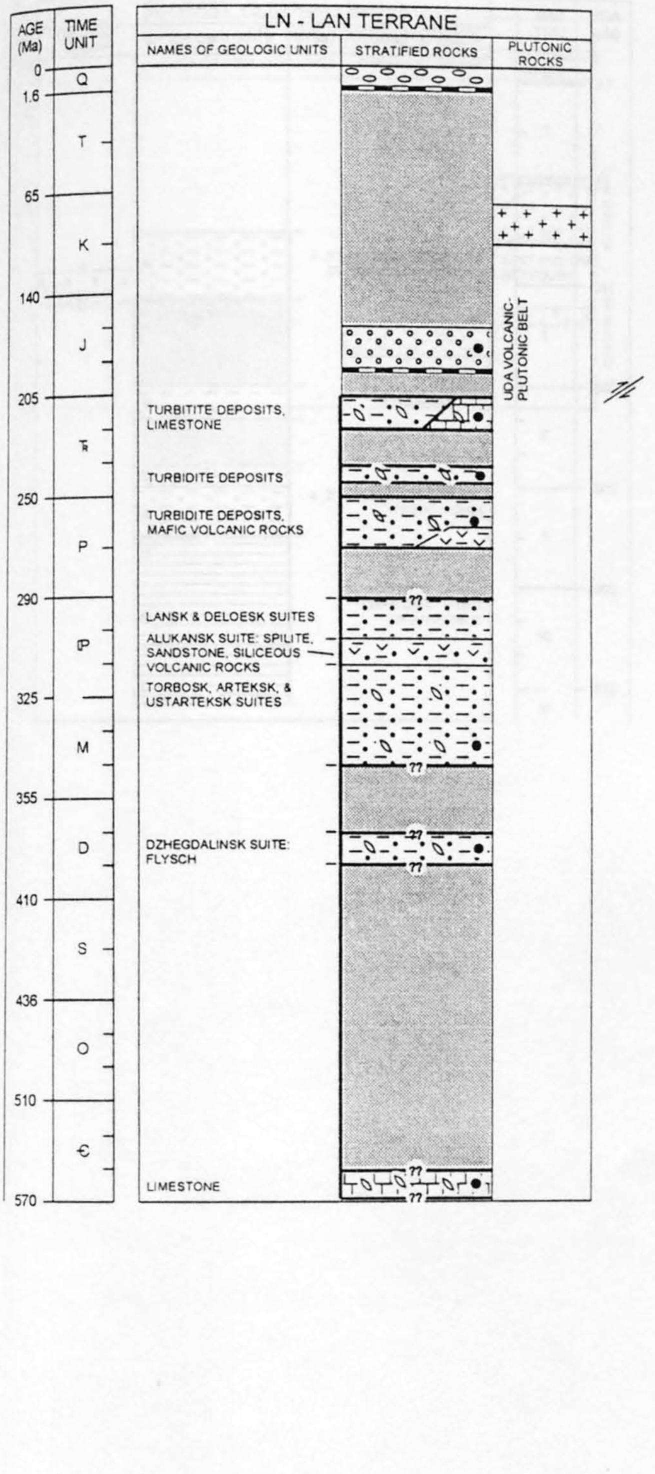
KT - KOTEL'NYI TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
250
P
290
325
M
355
D
410
S
436
O
510
MUDSTONE, SILTSTONE, SANDSTONE
BLACK SHALE
CONGLOMERATE, SANDSTONE
MUDSTONE, SILTSTONE, SANDSTONE
LIMESTONE, DOLOMITE, MARL
??
BASE NOT EXPOSED



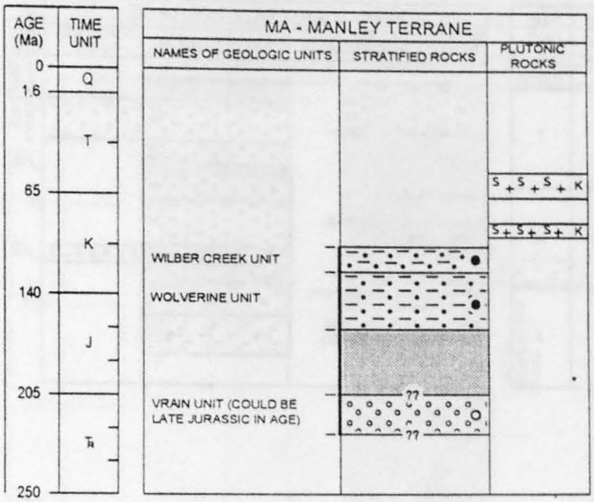
KV - KAMYSHOVY TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
POBEDINSKAY SEQUENCE
BASALT, CHERT


AGE (Ma)
TIME UNIT
LD - LAOELIN-GRODEKOV TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
Q
T
K
J
Ћ
P
ⲢP
M
D
S
BASALT
CONGLOMERATE, SANDSTONE
CONGLOMERATE, SANDSTONE
CONGLOMERATE, SANDSTONE
BASALT, ANDESITE, MUDSTONE, SHALE, LIMESTONE
BASALT, ANDESITE, TUFF, CONGLOMERATE, SANDSTONE

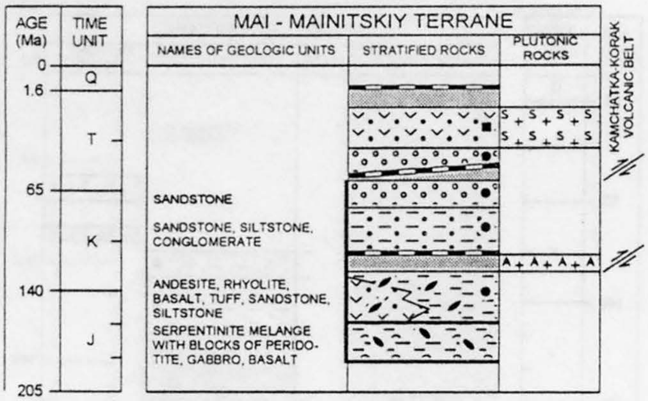

AGE (Ma)
TIME UNIT
LG - LIVENGOOD TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
Q
T
K
J
Ћ
P
ⲢP
M
D
S
O
Є
CASCADEN RIDGE UNIT
AMY CREEK & LOST CREEK UNITS
LIVENGOOD DOME CHERT
DIABASE, GABBRO, & HARZBURGITE

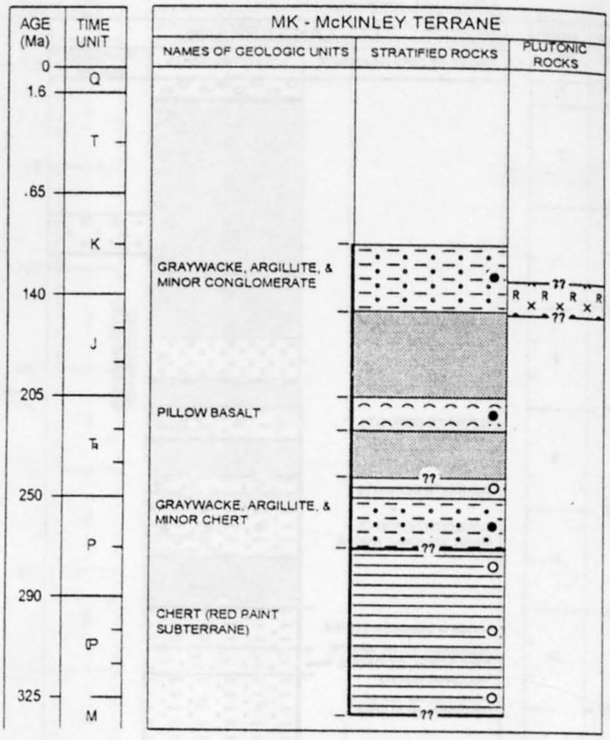


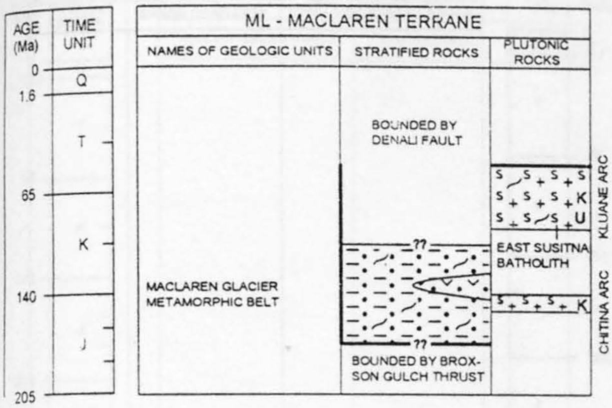
AGE (Ma)
TIME UNIT
LN - LAN TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
Q
T
K
J
P
M
D
S
O
UDA VOLCANIC-PLUTONIC BELT
TURBITITE DEPOSITS, LIMESTONE
TURBIDITE DEPOSITS
TURBIDITE DEPOSITS, MAFIC VOLCANIC ROCKS
LANSK & DELOESK SUITES
ALUKANSK SUITE: SPILITE, SANDSTONE, SILICEOUS VOLCANIC ROCKS
TORBOSK, ARTEKSK, & USTARTEKSK SUITES
DZHEGDALINSK SUITE: FLYSCH
LIMESTONE

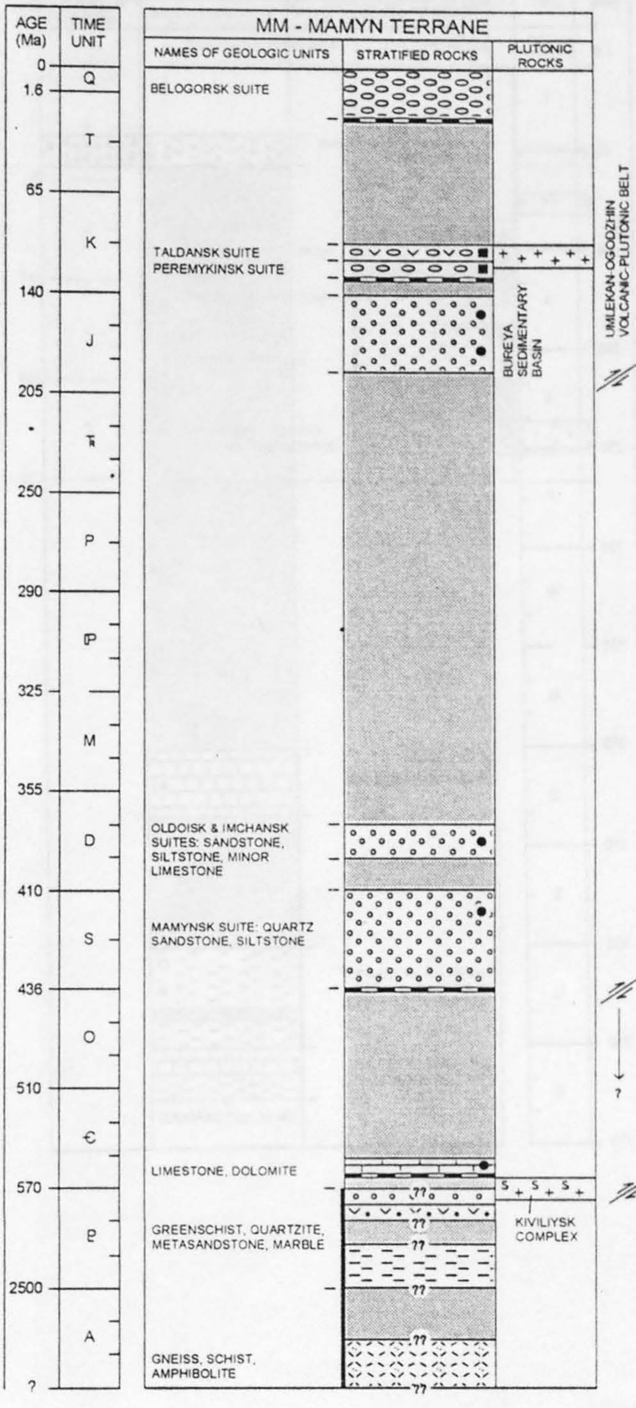


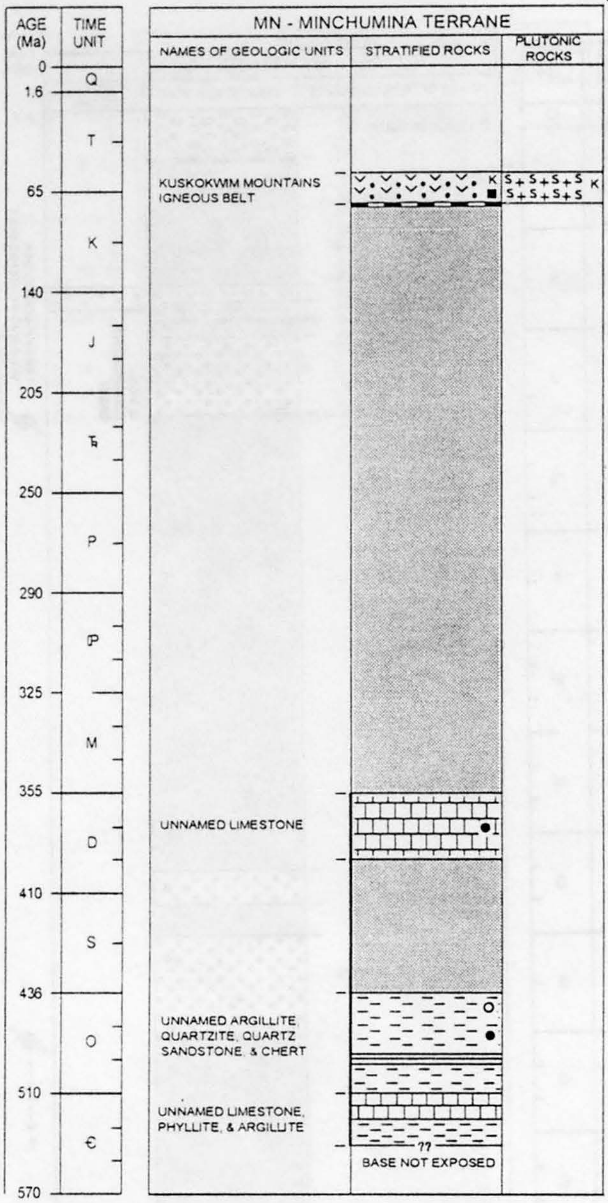
AGE (Ma)
TIME UNIT
MA - MANLEY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
WILBER CREEK UNIT
WOLVERINE UNIT
VRAIN UNIT (COULD BE LATE JURASSIC IN AGE)


AGE (Ma)
TIME UNIT
MAI - MAINITSKIY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
KAMCHATKA-KORAK VOLCANIC BELT
0
1.6
Q
T
65
K
140
J
205
SANDSTONE
SANDSTONE, SILTSTONE, CONGLOMERATE
ANDESITE, RHYOLITE, BASALT, TUFF, SANDSTONE, SILTSTONE
SERPENTINITE MELANGE WITH BLOCKS OF PERIDOTITE, GABBRO, BASALT

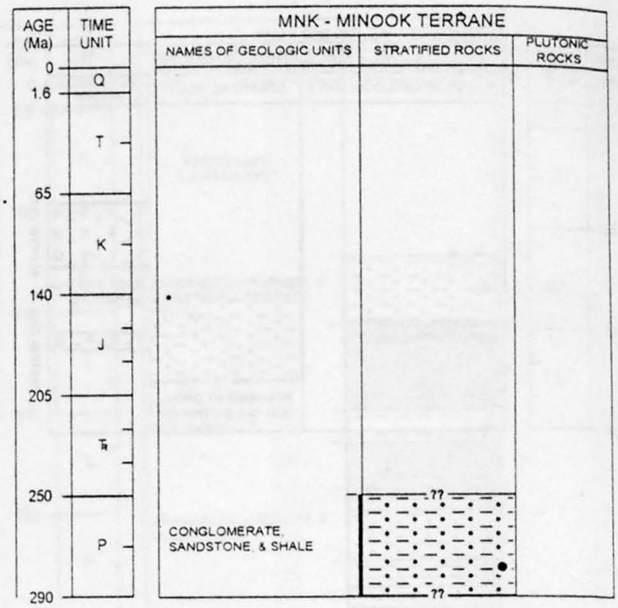

AGE (Ma)
TIME UNIT
MK - McKINLEY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
250
P
290
325
M
GRAYWACKE, ARGILLITE, & MINOR CONGLOMERATE
PILLOW BASALT
GRAYWACKE, ARGILLITE, & MINOR CHERT
CHERT (RED PAINT SUBTERRANE)


AGE (Ma)
TIME UNIT
ML - MACLAREN TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
BOUNDED BY DENALI FAULT
KLUANE ARC
EAST SUSITNA BATHOLITH
MACLAREN GLACIER METAMORPHIC BELT
CHITINA ARC
BOUNDED BY BROXSON GULCH THRUST

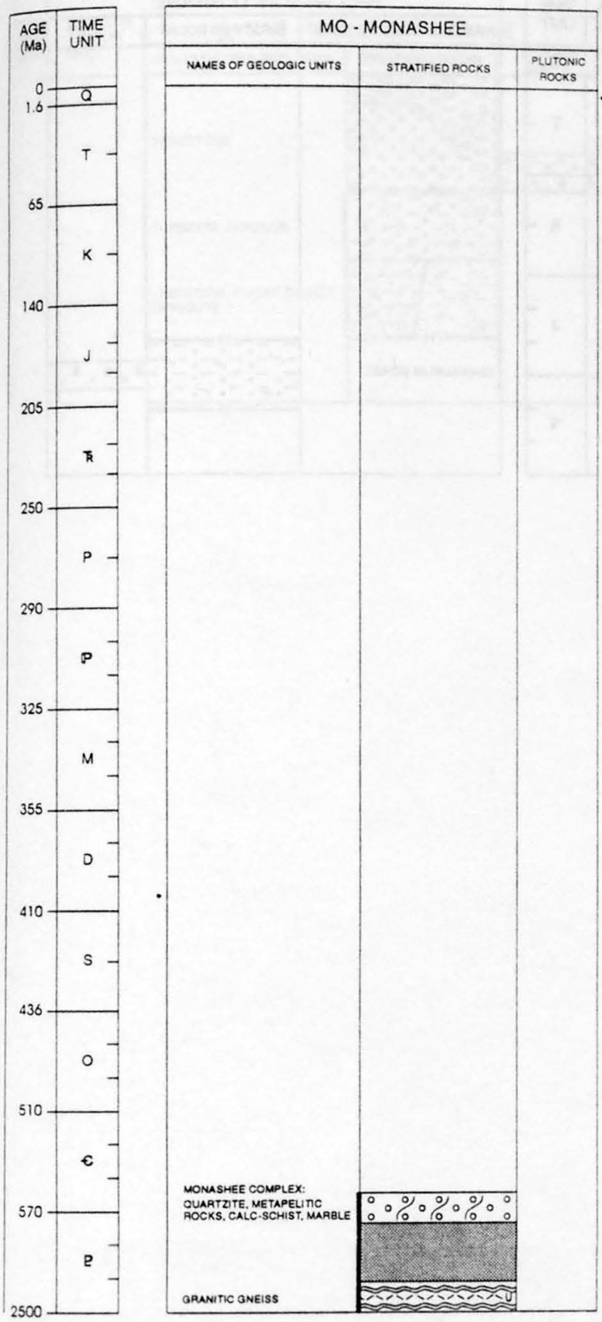

AGE (Ma)
TIME UNIT
MM - MAMYN TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
BELOGORSK SUITE
T
65
K
TALDANSK SUITE
PEREMYKINSK SUITE
140
J
BUREYA SEDIMENTARY BASIN
UMLEKAN-OGODZHIN VOLCANIC-PLUTONIC BELT
205
250
P
290
325
M
355
D
OLDOISK & IMCHANSK SUITES: SANDSTONE, SILTSTONE, MINOR LIMESTONE
410
S
MAMYNSK SUITE: QUARTZ SANDSTONE, SILTSTONE
436
O
510
LIMESTONE, DOLOMITE
570
GREENSCHIST, QUARTZITE, METASANDSTONE, MARBLE
KIVILIYSK COMPLEX
2500
A
GNEISS, SCHIST, AMPHIBOLITE
?

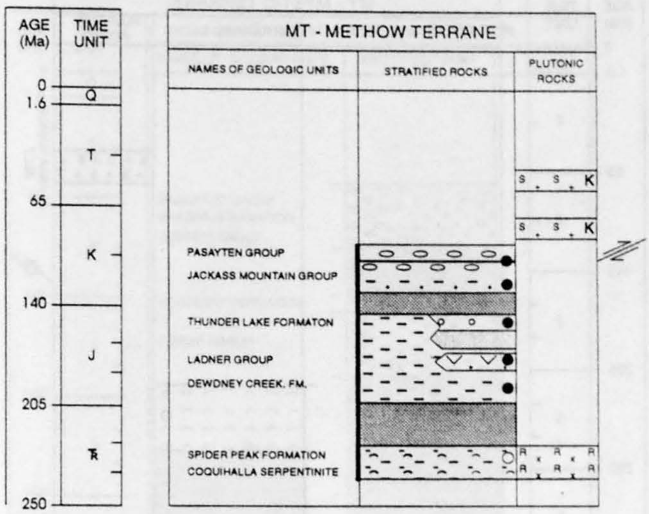


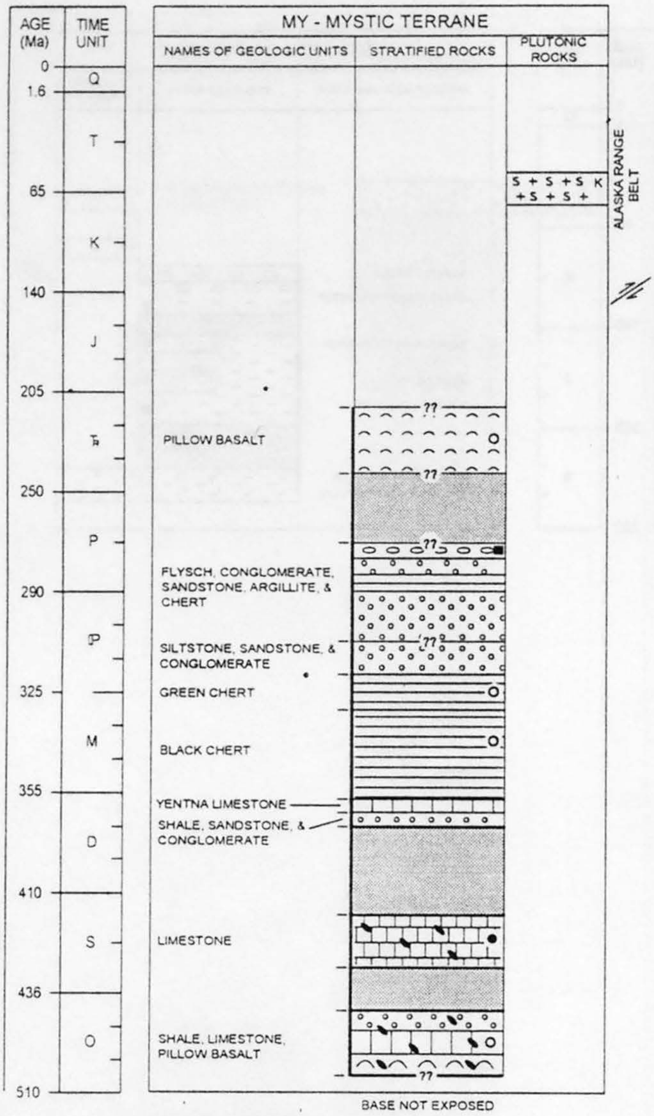
MN - MINCHUMINA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
Q
T
K
J
Ꝧ
P
ꟼ
M
D
S
O
€
KUSKOKWIM MOUNTAINS IGNEOUS BELT
UNNAMED LIMESTONE
UNNAMED ARGILLITE, QUARTZITE, QUARTZ SANDSTONE, & CHERT
UNNAMED LIMESTONE, PHYLLITE, & ARGILLITE
BASE NOT EXPOSED

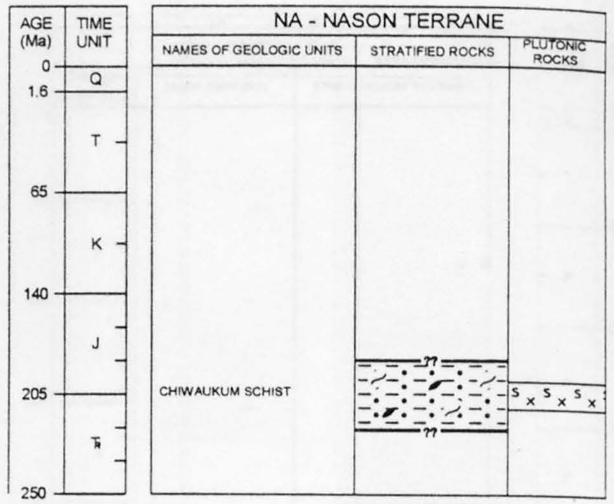


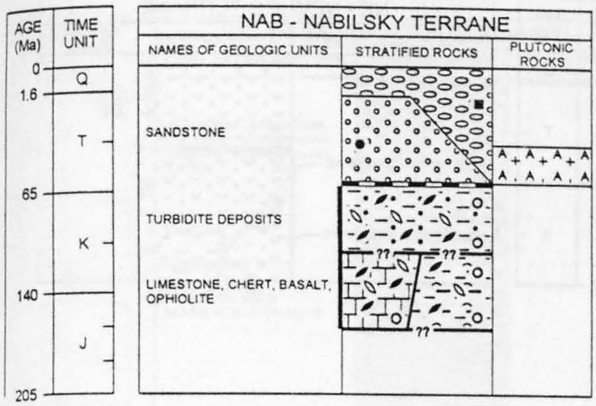
MNK - MINOOK TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
Q
T
K
J
Ꝧ
P
CONGLOMERATE, SANDSTONE, & SHALE

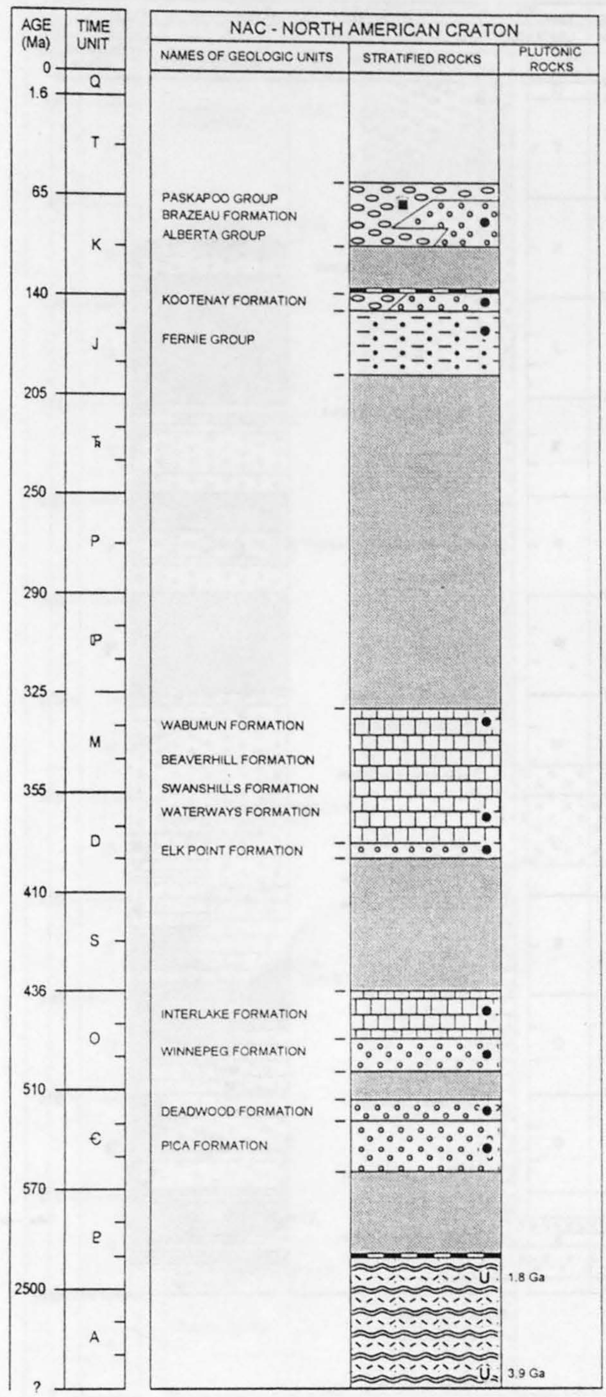

MO - MONASHEE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
P
M
D
S
O
MONASHEE COMPLEX: QUARTZITE, METAPELITIC ROCKS, CALC-SCHIST, MARBLE
GRANITIC GNEISS

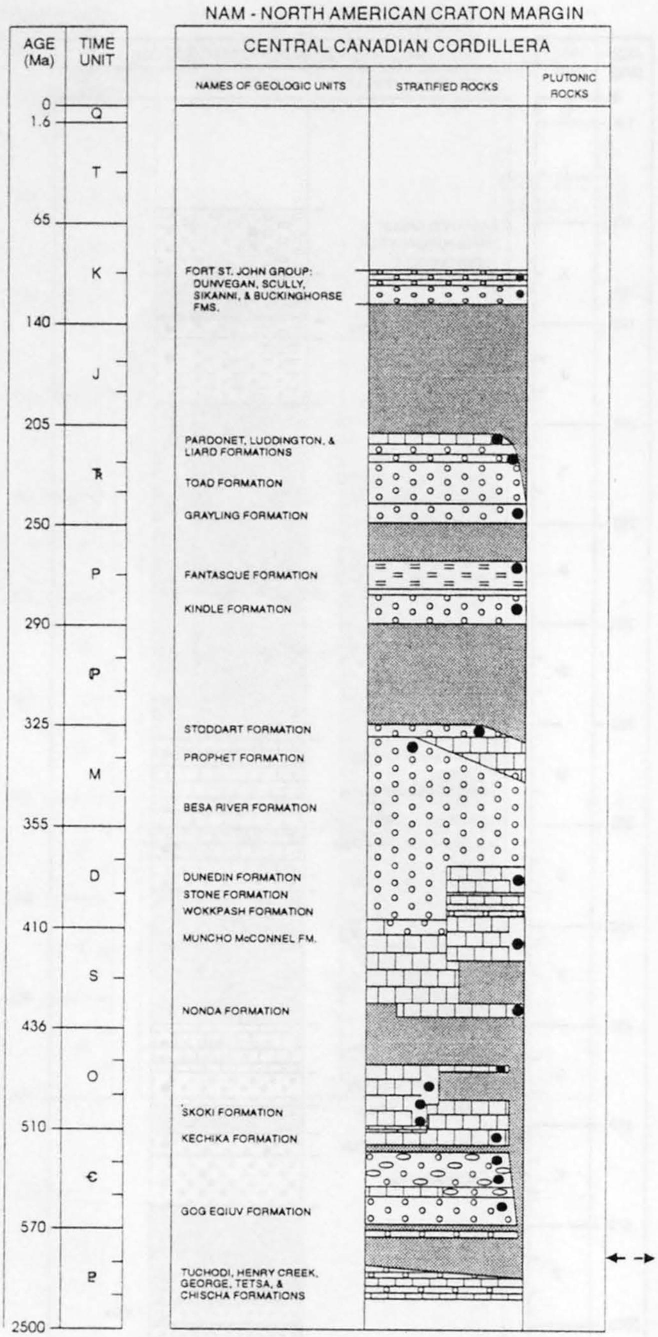

MT - METHOW TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
PASAYTEN GROUP
JACKASS MOUNTAIN GROUP
THUNDER LAKE FORMATON
LADNER GROUP
DEWDNEY CREEK. FM.
SPIDER PEAK FORMATION
COQUIHALLA SERPENTINITE

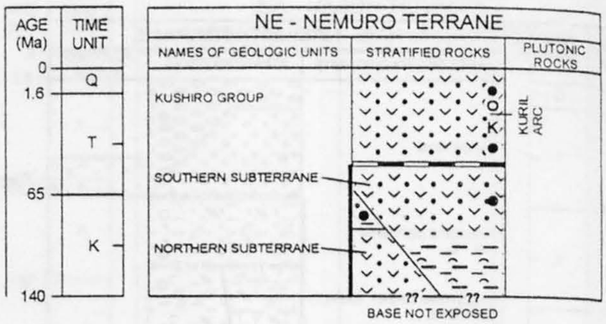

MY - MYSTIC TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
Q
T
K
J
Ђ
P
ℙ
M
D
S
O
ALASKA RANGE BELT
PILLOW BASALT
FLYSCH, CONGLOMERATE, SANDSTONE, ARGILLITE, & CHERT
SILTSTONE, SANDSTONE, & CONGLOMERATE
GREEN CHERT
BLACK CHERT
YENTNA LIMESTONE
SHALE, SANDSTONE, & CONGLOMERATE
LIMESTONE
SHALE, LIMESTONE, PILLOW BASALT
BASE NOT EXPOSED

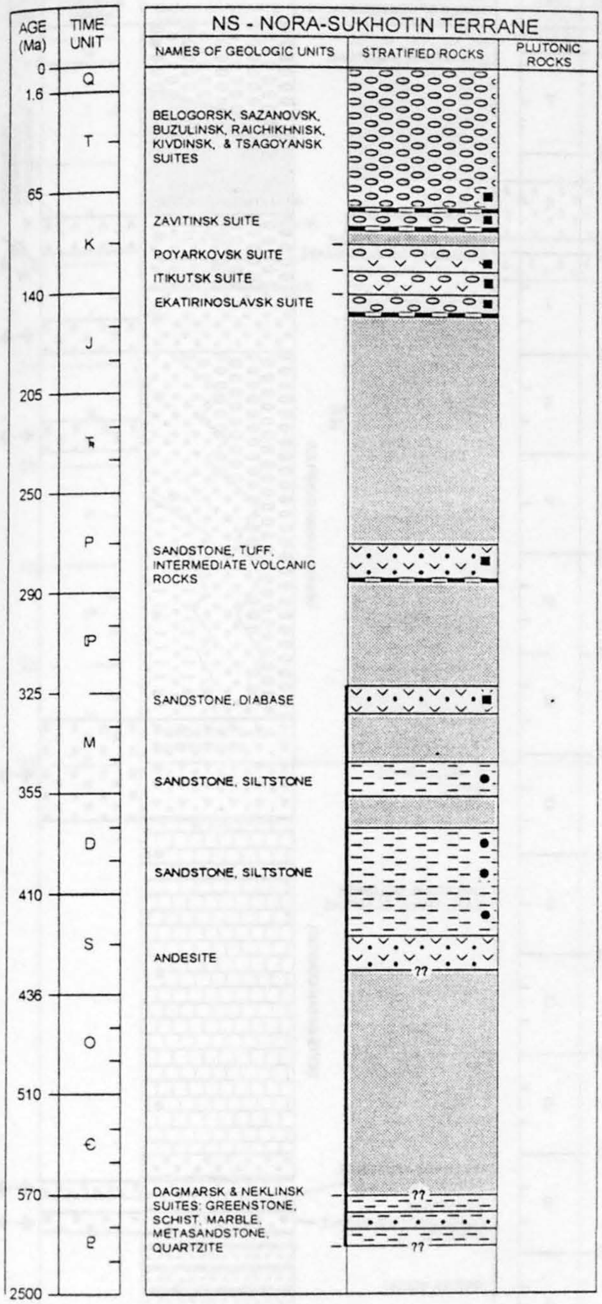
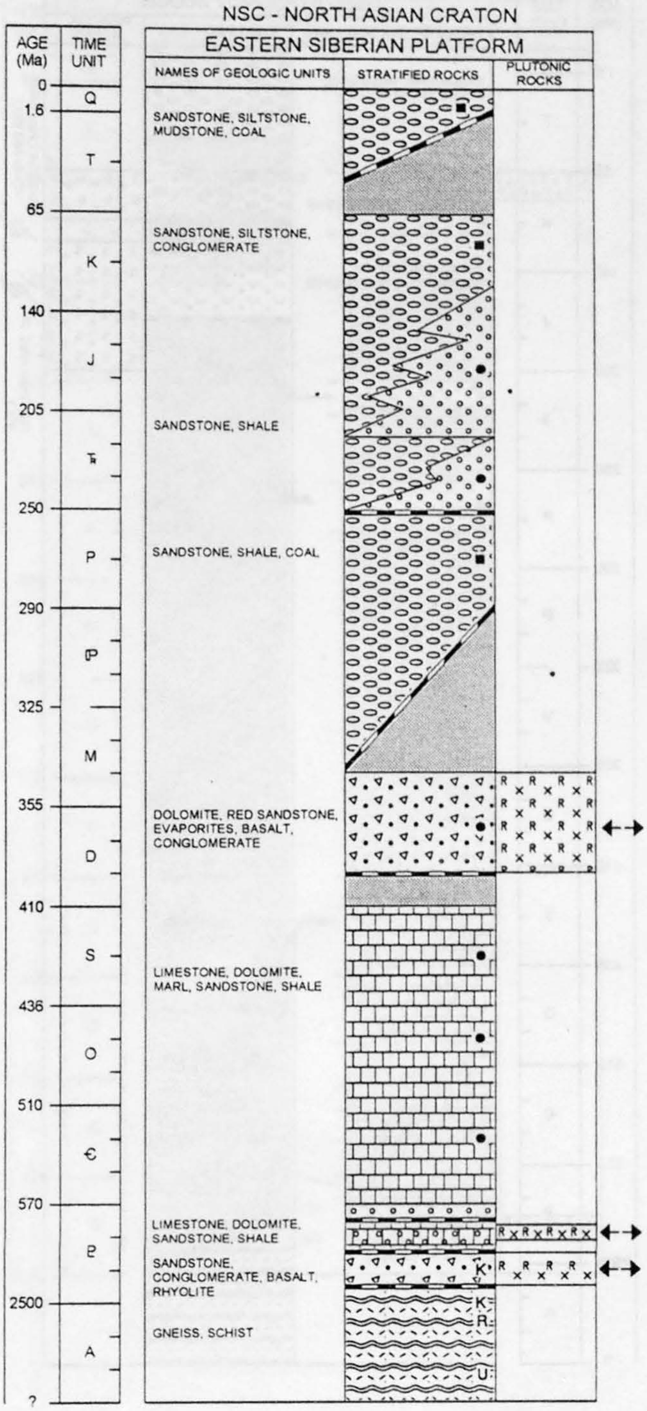

NA - NASON TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
Ђ
CHIWAUKUM SCHIST

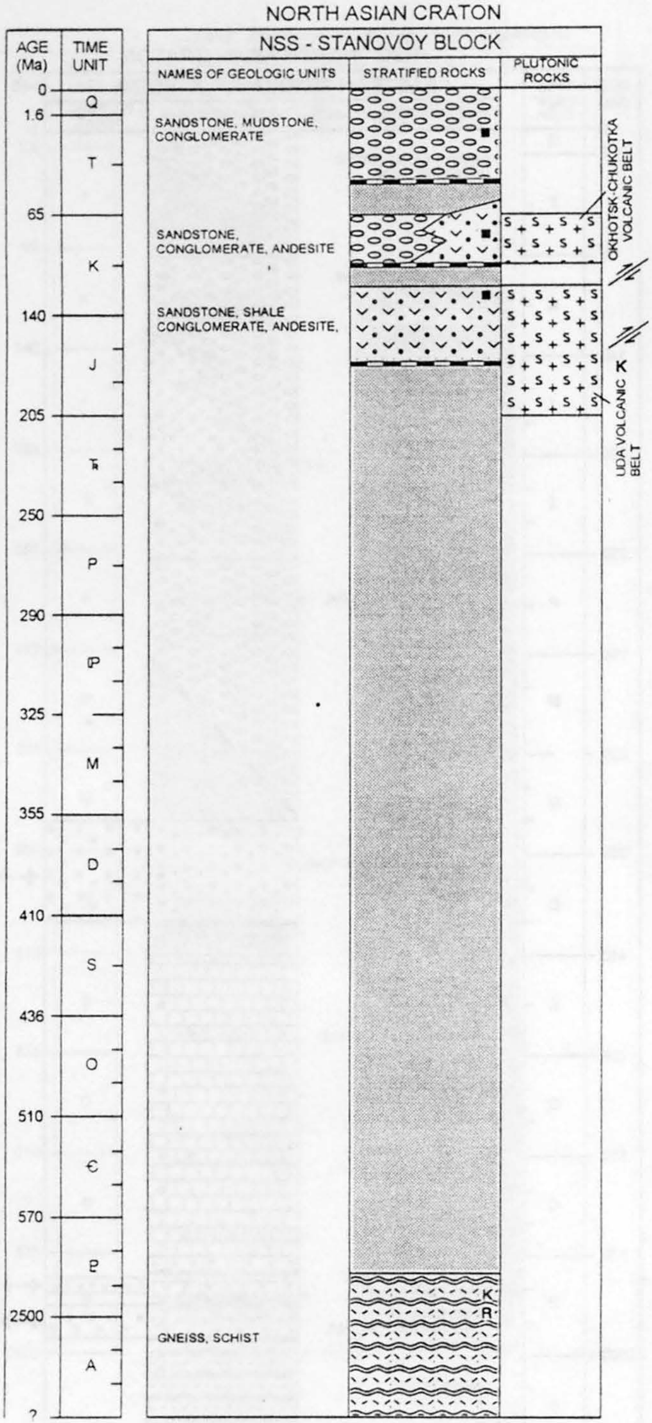

AGE (Ma)
TIME UNIT
0
1.6
65
140
205
Q
T
K
J
NAB - NABILSKY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SANDSTONE
TURBIDITE DEPOSITS
LIMESTONE, CHERT, BASALT, OPHIOLITE

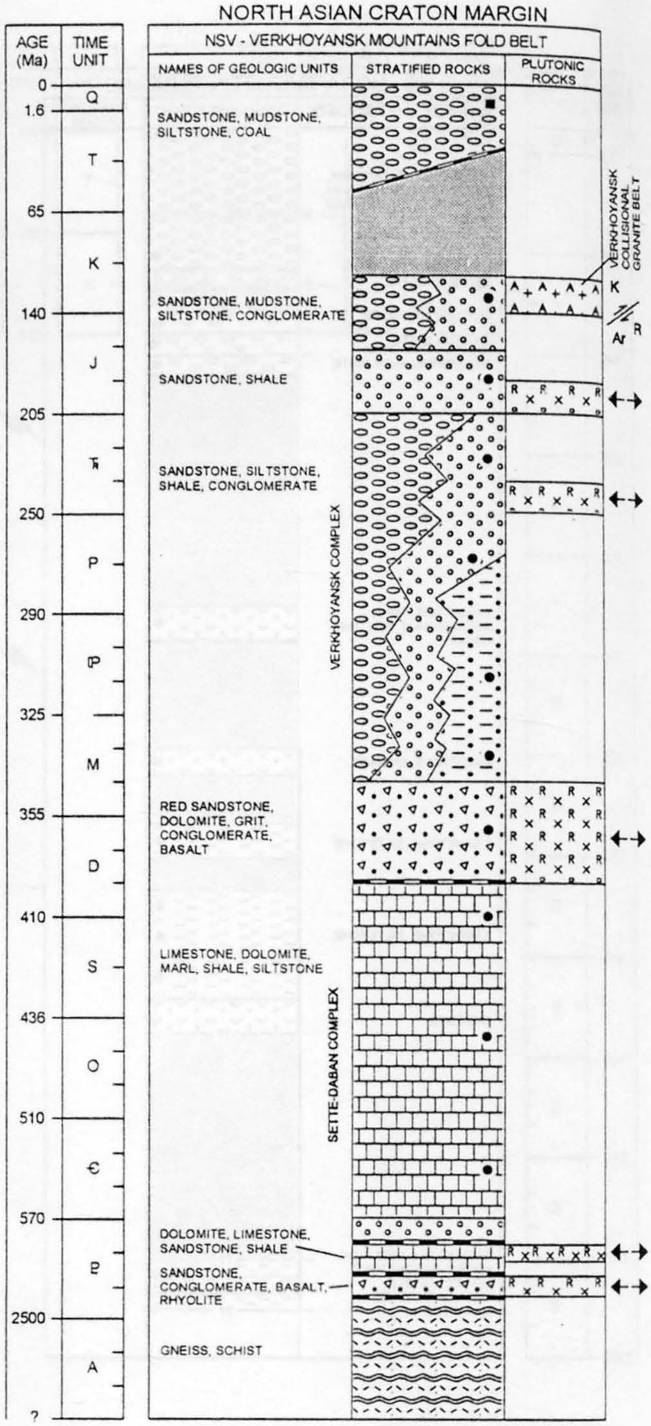

AGE (Ma)
TIME UNIT
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
P
M
D
S
O
A
NAC - NORTH AMERICAN CRATON
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
PASKAPOO GROUP
BRAZEAU FORMATION
ALBERTA GROUP
KOOTENAY FORMATION
FERNIE GROUP
WABUMUN FORMATION
BEAVERHILL FORMATION
SWANSHILLS FORMATION
WATERWAYS FORMATION
ELK POINT FORMATION
INTERLAKE FORMATION
WINNEPEG FORMATION
DEADWOOD FORMATION
PICA FORMATION
1.8 Ga
3.9 Ga

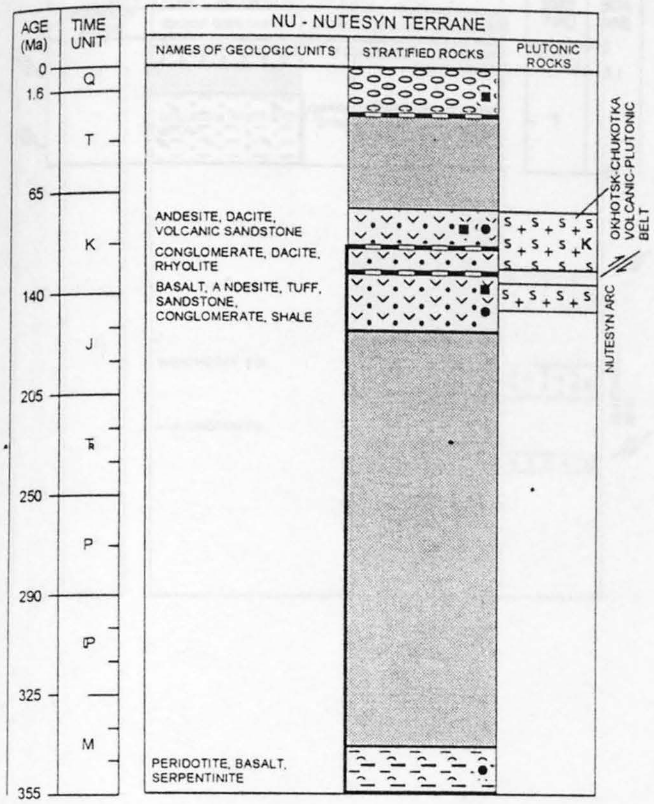

NAM - NORTH AMERICAN CRATON MARGIN
CENTRAL CANADIAN CORDILLERA
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
Ћ
250
P
290
Ꝑ
325
M
355
D
410
S
436
O
510
Є
570
Ꝑ
2500
FORT ST. JOHN GROUP: DUNVEGAN, SCULLY, SIKANNI, & BUCKINGHORSE FMS.
PARDONET, LUDDINGTON, & LIARD FORMATIONS
TOAD FORMATION
GRAYLING FORMATION
FANTASQUE FORMATION
KINDLE FORMATION
STODDART FORMATION
PROPHET FORMATION
BESA RIVER FORMATION
DUNEDIN FORMATION
STONE FORMATION
WOKKPASH FORMATION
MUNCHO McCONNEL FM.
NONDA FORMATION
SKOKI FORMATION
KECHIKA FORMATION
GOG EQIUV FORMATION
TUCHODI, HENRY CREEK, GEORGE, TETSA, & CHISCHA FORMATIONS


NE - NEMURO TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
KUSHIRO GROUP
KURIL ARC
SOUTHERN SUBTERRANE
NORTHERN SUBTERRANE
??
BASE NOT EXPOSED

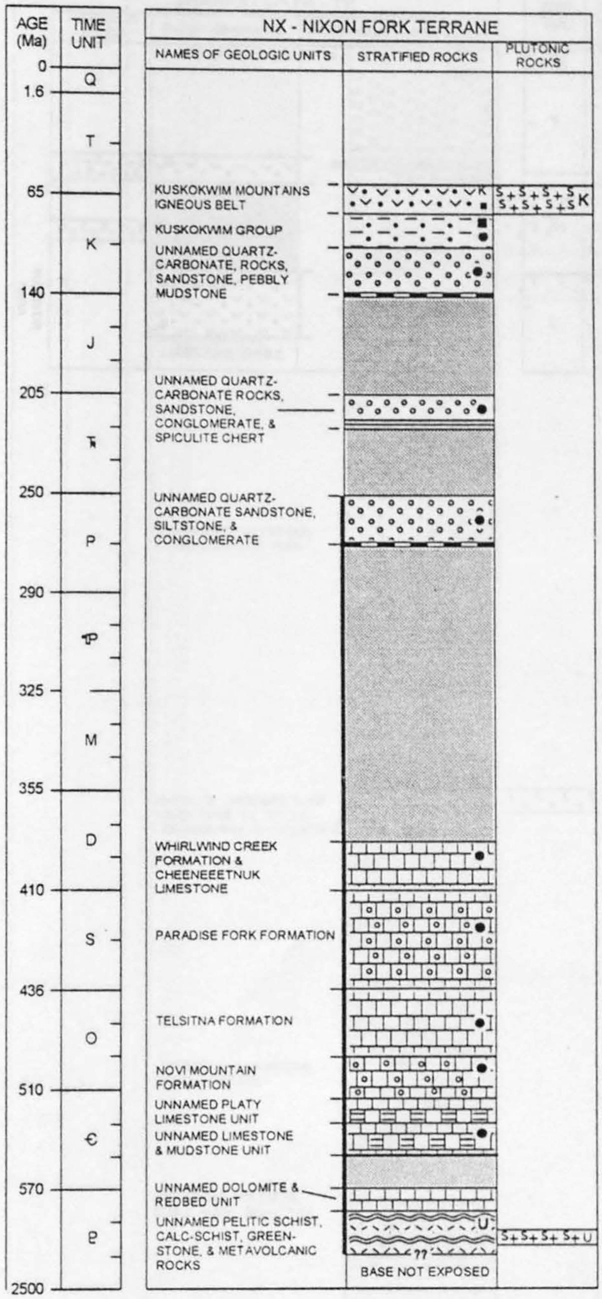

NS - NORA-SUKHOTIN TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
BELOGORSK, SAZANOVSK, BUZULINSK, RAICHIKHNISK, KIVDINSK, & TSAGOYANSK SUITES
ZAVITINSK SUITE
POYARKOVSK SUITE
ITIKUTSK SUITE
EKATIRINOSLAVSK SUITE
SANDSTONE, TUFF, INTERMEDIATE VOLCANIC ROCKS
SANDSTONE, DIABASE
SANDSTONE, SILTSTONE
SANDSTONE, SILTSTONE
ANDESITE
DAGMARSK & NEKLINSK SUITES: GREENSTONE, SCHIST, MARBLE, METASANDSTONE, QUARTZITE
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
P
M
D
S
O
€

NSC - NORTH ASIAN CRATON
EASTERN SIBERIAN PLATFORM
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SANDSTONE, SILTSTONE, MUDSTONE, COAL
SANDSTONE, SILTSTONE, CONGLOMERATE
SANDSTONE, SHALE
SANDSTONE, SHALE, COAL
DOLOMITE, RED SANDSTONE, EVAPORITES, BASALT, CONGLOMERATE
LIMESTONE, DOLOMITE, MARL, SANDSTONE, SHALE
LIMESTONE, DOLOMITE, SANDSTONE, SHALE
SANDSTONE, CONGLOMERATE, BASALT, RHYOLITE
GNEISS, SCHIST
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
P
M
D
S
O
€
A


NORTH ASIAN CRATON
NSS - STANOVOY BLOCK
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
Ŧ
P
ℙ
M
D
S
O
Є
Ᵽ
A
SANDSTONE, MUDSTONE, CONGLOMERATE
SANDSTONE, CONGLOMERATE, ANDESITE
SANDSTONE, SHALE CONGLOMERATE, ANDESITE,
GNEISS, SCHIST
OKHOTSK-CHUKOTKA VOLCANIC BELT
UDA VOLCANIC BELT
K
R

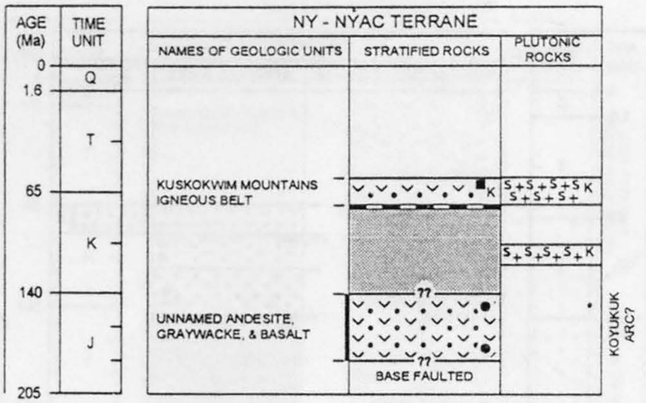

NORTH ASIAN CRATON MARGIN
NSV - VERKHOYANSK MOUNTAINS FOLD BELT
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
Ŧ
P
ℙ
M
D
S
O
Є
Ᵽ
A
SANDSTONE, MUDSTONE, SILTSTONE, COAL
SANDSTONE, MUDSTONE, SILTSTONE, CONGLOMERATE
SANDSTONE, SHALE
SANDSTONE, SILTSTONE, SHALE, CONGLOMERATE
RED SANDSTONE, DOLOMITE, GRIT, CONGLOMERATE, BASALT
LIMESTONE, DOLOMITE, MARL, SHALE, SILTSTONE
DOLOMITE, LIMESTONE, SANDSTONE, SHALE
SANDSTONE, CONGLOMERATE, BASALT, RHYOLITE
GNEISS, SCHIST
VERKHOYANSK COMPLEX
SETTE-DABAN COMPLEX
VERKHOYANSK COLLISIONAL GRANITE BELT
K
Ar
R

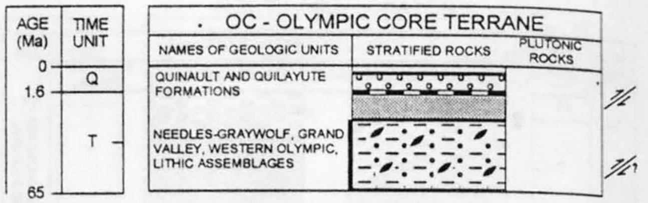


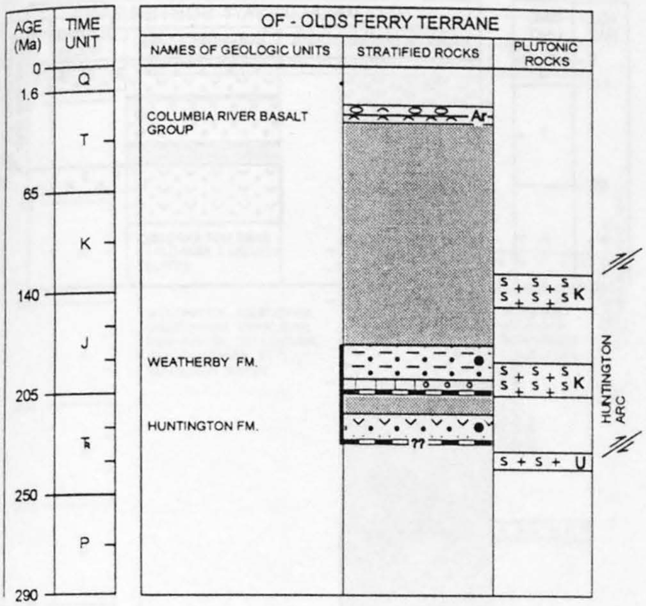
AGE (Ma)
TIME UNIT
NU - NUTESYN TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
ANDESITE, DACITE, VOLCANIC SANDSTONE
CONGLOMERATE, DACITE, RHYOLITE
BASALT, ANDESITE, TUFF, SANDSTONE, CONGLOMERATE, SHALE
PERIDOTITE, BASALT, SERPENTINITE
OKHOTSK-CHUKOTKA VOLCANIC-PLUTONIC BELT
NUTESYN ARC

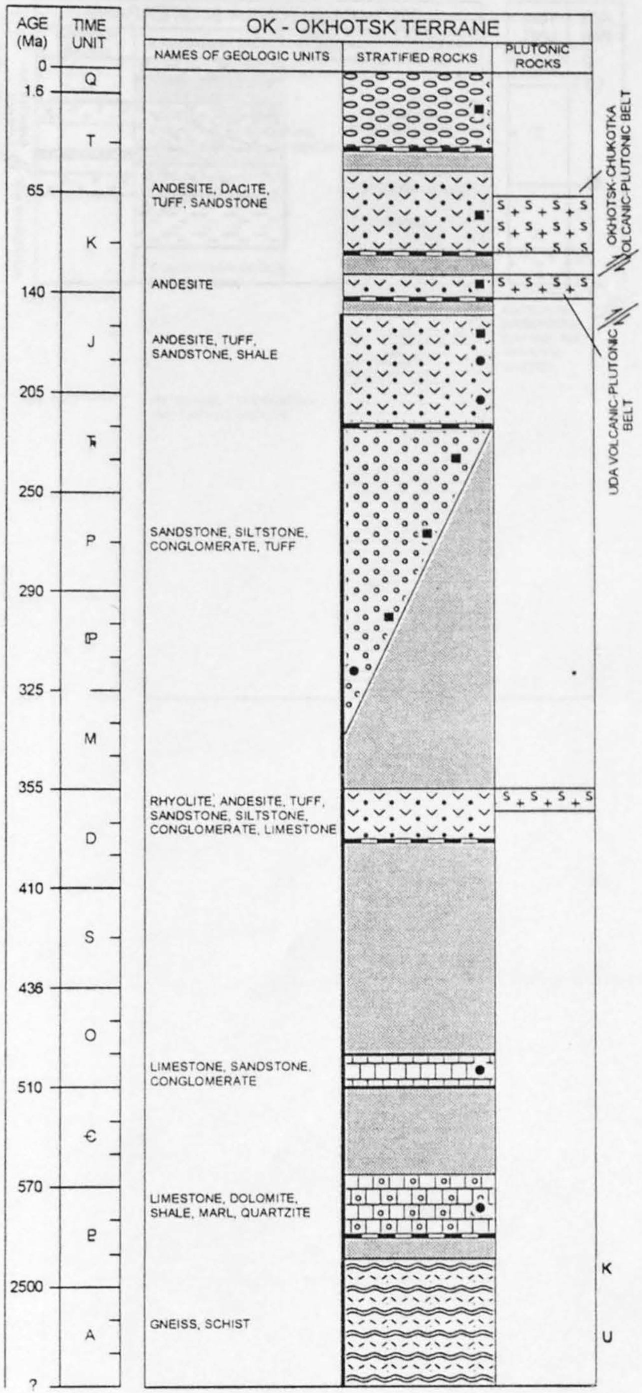


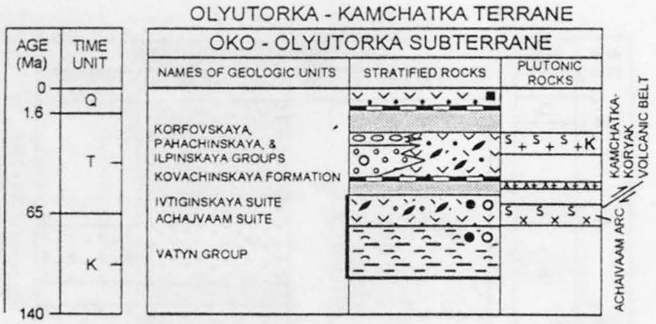
AGE (Ma)
TIME UNIT
NX - NIXON FORK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
KUSKOKWIM MOUNTAINS IGNEOUS BELT
KUSKOKWIM GROUP
UNNAMED QUARTZ-CARBONATE, ROCKS, SANDSTONE, PEBBLY MUDSTONE
UNNAMED QUARTZ-CARBONATE ROCKS, SANDSTONE, CONGLOMERATE, & SPICULITE CHERT
UNNAMED QUARTZ-CARBONATE SANDSTONE, SILTSTONE, & CONGLOMERATE
WHIRLWIND CREEK FORMATION & CHEENEEETNUK LIMESTONE
PARADISE FORK FORMATION
TELSITNA FORMATION
NOVI MOUNTAIN FORMATION
UNNAMED PLATY LIMESTONE UNIT
UNNAMED LIMESTONE & MUDSTONE UNIT
UNNAMED DOLOMITE & REDBED UNIT
UNNAMED PELITIC SCHIST, CALC-SCHIST, GREEN-STONE, & METAVOLCANIC ROCKS
BASE NOT EXPOSED

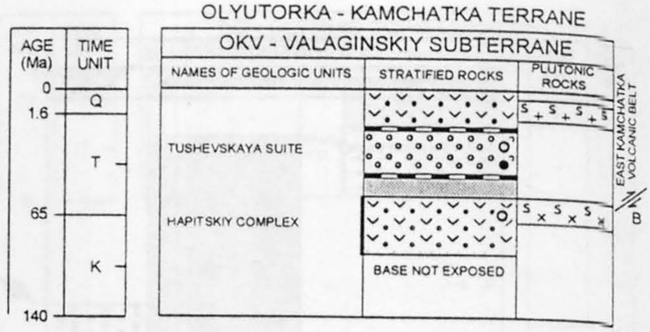

AGE (Ma)
TIME UNIT
NY - NYAC TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
KUSKOKWIM MOUNTAINS IGNEOUS BELT
K
140
UNNAMED ANDESITE, GRAYWACKE, & BASALT
J
205
??
BASE FAULTED
KOYUKUK ARC?

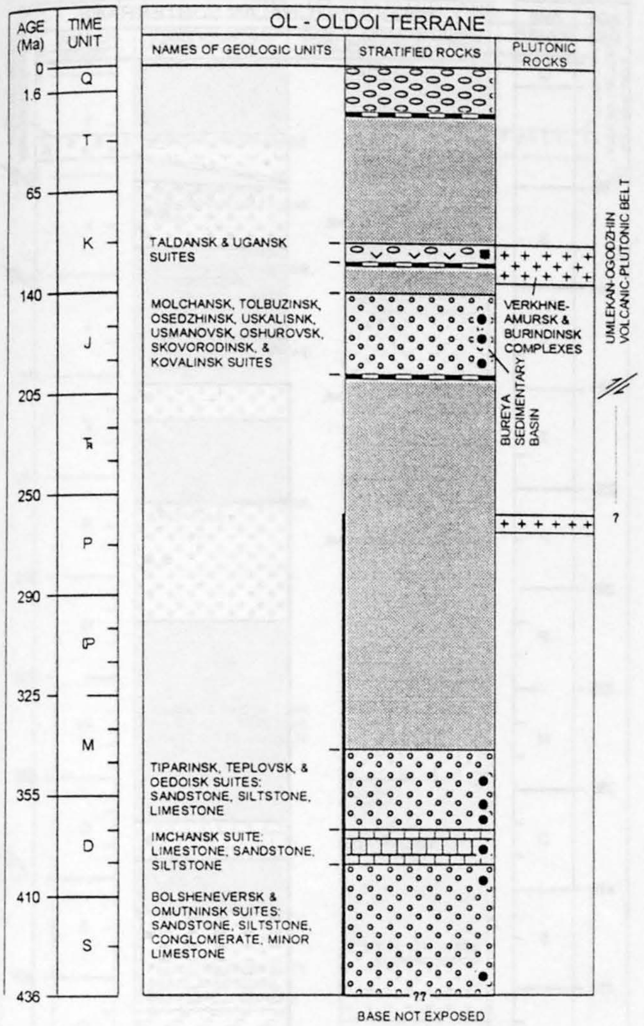

AGE (Ma)
TIME UNIT
OC - OLYMPIC CORE TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
QUINAULT AND QUILAYUTE FORMATIONS
T
NEEDLES-GRAYWOLF, GRAND VALLEY, WESTERN OLYMPIC, LITHIC ASSEMBLAGES
65

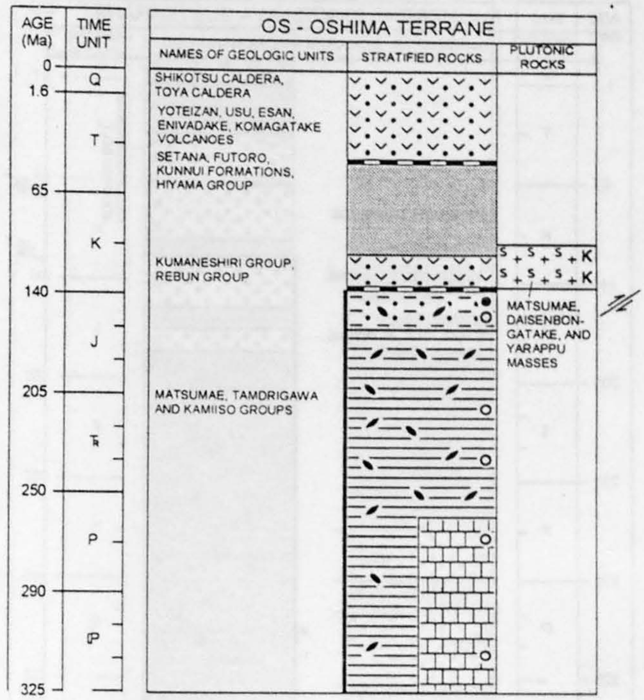

OF - OLDS FERRY TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
COLUMBIA RIVER BASALT GROUP
WEATHERBY FM.
HUNTINGTON FM.
HUNTINGTON ARC
0
1.6
65
140
205
250
290
Q
T
K
J
P
Ar
K
U

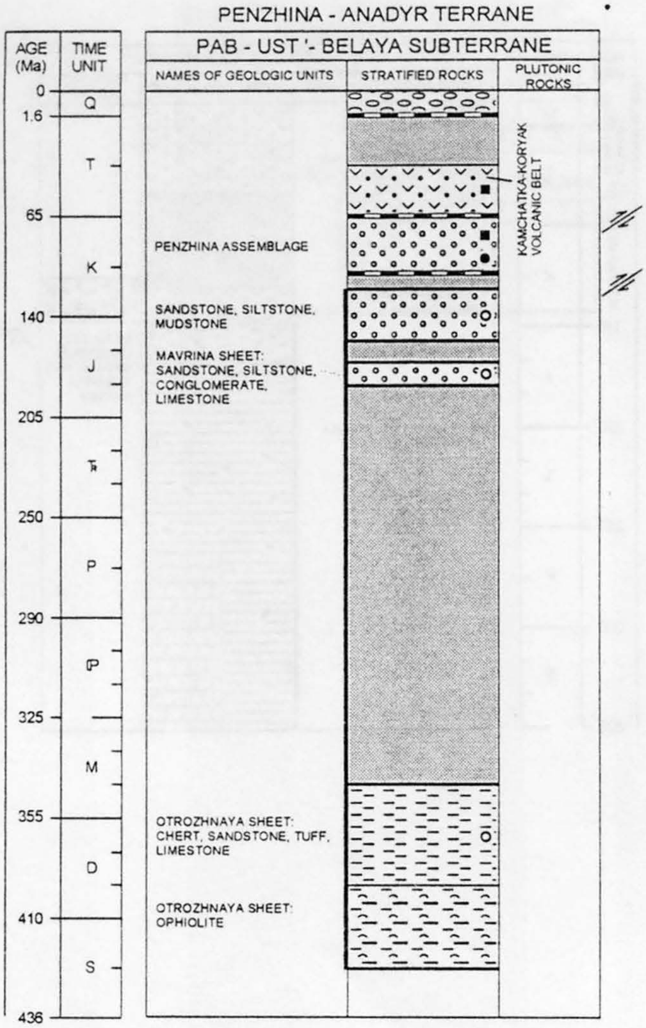

OK - OKHOTSK TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
ANDESITE, DACITE, TUFF, SANDSTONE
ANDESITE
ANDESITE, TUFF, SANDSTONE, SHALE
SANDSTONE, SILTSTONE, CONGLOMERATE, TUFF
RHYOLITE, ANDESITE, TUFF, SANDSTONE, SILTSTONE, CONGLOMERATE, LIMESTONE
LIMESTONE, SANDSTONE, CONGLOMERATE
LIMESTONE, DOLOMITE, SHALE, MARL, QUARTZITE
GNEISS, SCHIST
OKHOTSK-CHUKOTKA VOLCANIC-PLUTONIC BELT
UDA VOLCANIC-PLUTONIC BELT
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
P
M
D
S
O
A
K
U

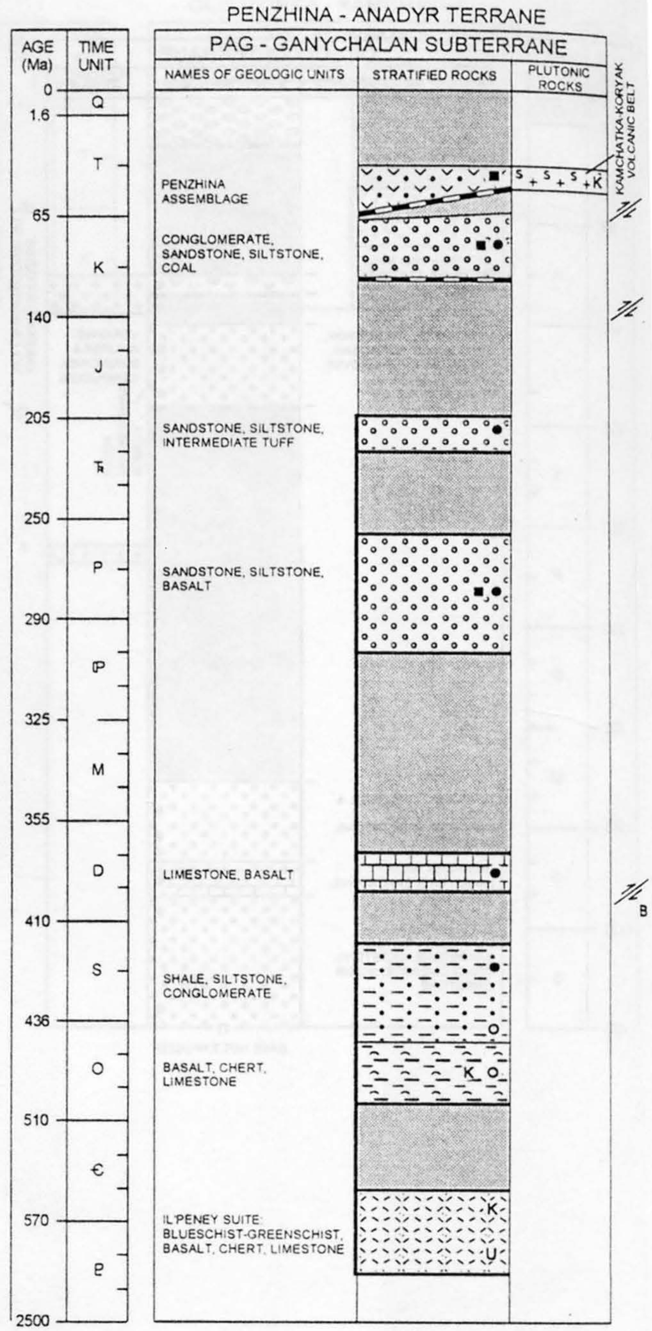

OLYUTORKA - KAMCHATKA TERRANE
OKO - OLYUTORKA SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
Q
T
K
KORFOVSKAYA, PAHACHINSKAYA, & ILPINSKAYA GROUPS
KOVACHINSKAYA FORMATION
IVTIGINSKAYA SUITE
ACHAJVAAM SUITE
VATYN GROUP
KAMCHATKA-KORYAK VOLCANIC BELT
ACHAIVAAM ARC


OLYUTORKA - KAMCHATKA TERRANE
OKV - VALAGINSKIY SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
Q
T
K
TUSHEVSKAYA SUITE
HAPITSKIY COMPLEX
BASE NOT EXPOSED
EAST KAMCHATKA VOLCANIC BELT
B

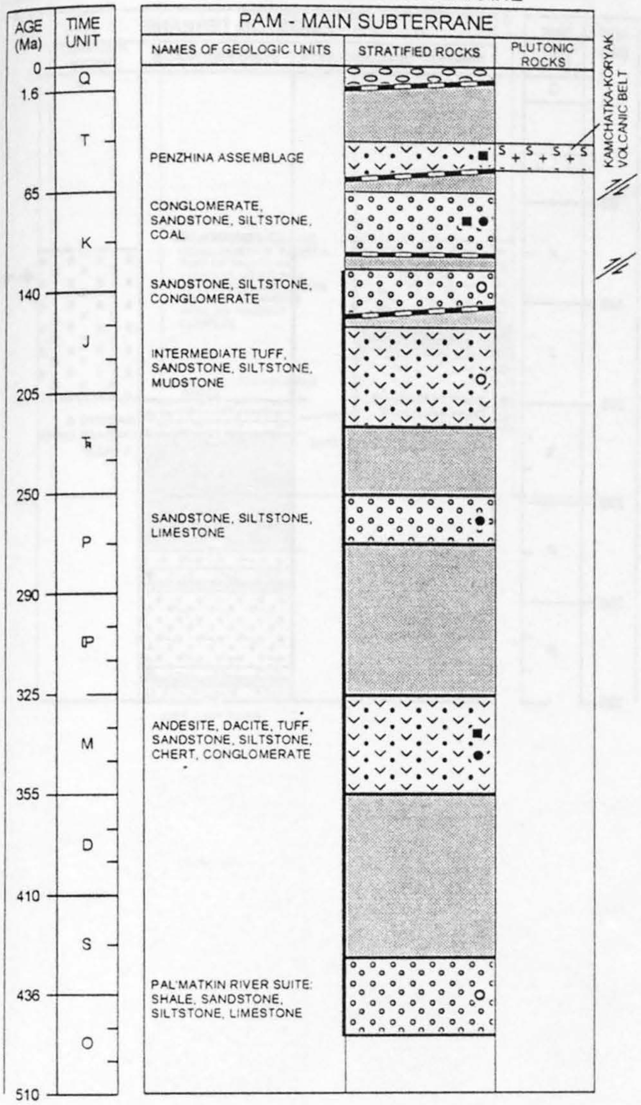

AGE (Ma)
TIME UNIT
OL - OLDOI TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
TALDANSK & UGANSK SUITES
MOLCHANSK, TOLBUZINSK, OSEDZHINSK, USKALISNK, USMANOVSK, OSHUROVSK, SKOVORODINSK, & KOVALINSK SUITES
VERKHNE-AMURSK & BURINDINSK COMPLEXES
BUREYA SEDIMENTARY BASIN
UMLEKAN-OGODZHIN VOLCANIC-PLUTONIC BELT
TIPARINSK, TEPLOVSK, & OEDOISK SUITES: SANDSTONE, SILTSTONE, LIMESTONE
IMCHANSK SUITE: LIMESTONE, SANDSTONE, SILTSTONE
BOLSHENEVERSK & OMUTNINSK SUITES: SANDSTONE, SILTSTONE, CONGLOMERATE, MINOR LIMESTONE
BASE NOT EXPOSED
0
1.6
65
140
205
250
290
325
355
410
436
Q
T
K
J
P
M
D
S

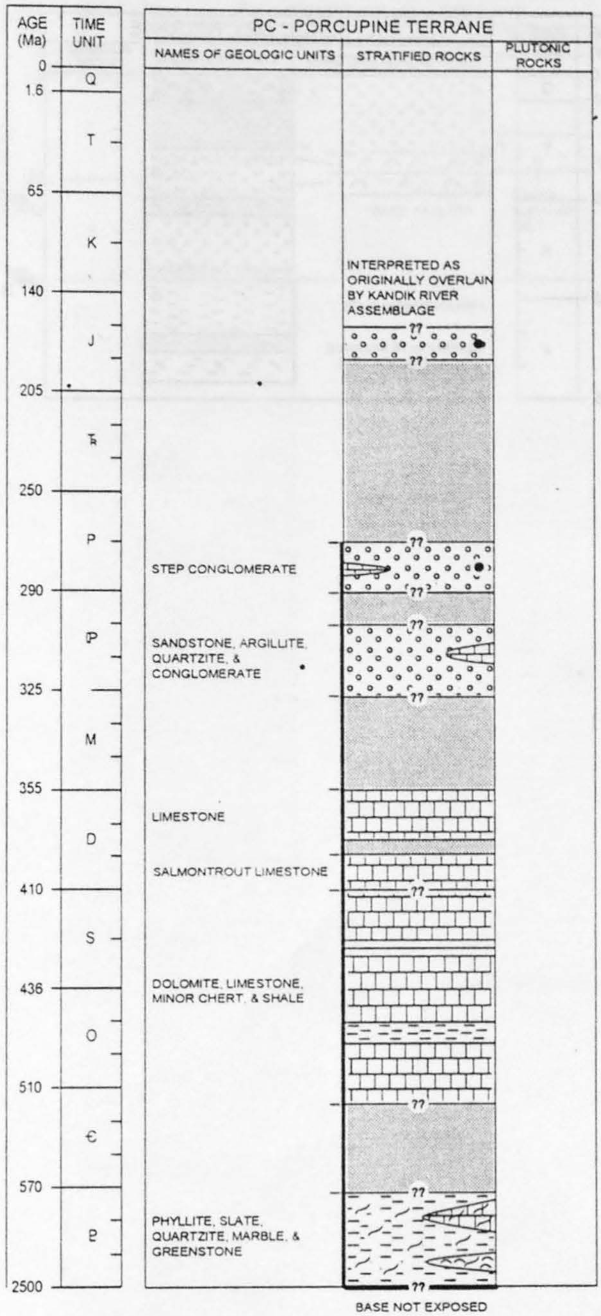

AGE (Ma)
TIME UNIT
OS - OSHIMA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
SHIKOTSU CALDERA, TOYA CALDERA
YOTEIZAN, USU, ESAN, ENIVADAKE, KOMAGATAKE VOLCANOES
SETANA, FUTORO, KUNNUI FORMATIONS, HIYAMA GROUP
KUMANESHIRI GROUP, REBUN GROUP
MATSUMAE, TAMDRIGAWA AND KAMIISO GROUPS
MATSUMAE, DAISENBON-GATAKE, AND YARAPPU MASSES
0
1.6
65
140
205
250
290
325
Q
T
K
J
P

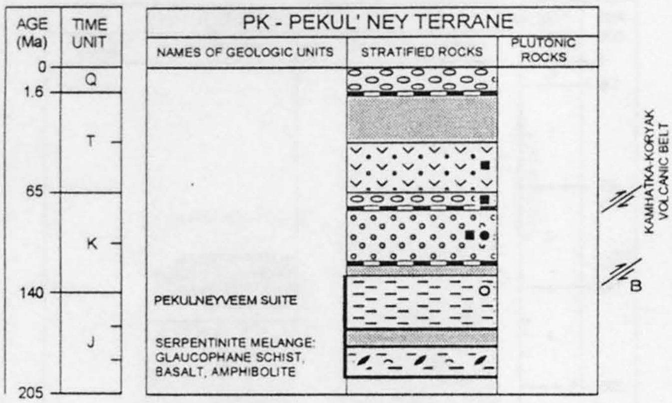

PENZHINA - ANADYR TERRANE
PAB - UST '- BELAYA SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
Q
T
K
J
M
D
S
KAMCHATKA-KORYAK VOLCANIC BELT
PENZHINA ASSEMBLAGE
SANDSTONE, SILTSTONE, MUDSTONE
MAVRINA SHEET: SANDSTONE, SILTSTONE, CONGLOMERATE, LIMESTONE
OTROZHNAYA SHEET: CHERT, SANDSTONE, TUFF, LIMESTONE
OTROZHNAYA SHEET: OPHIOLITE


PENZHINA - ANADYR TERRANE
PAG - GANYCHALAN SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
M
D
S
O
KAMCHATKA-KORYAK VOLCANIC BELT
PENZHINA ASSEMBLAGE
CONGLOMERATE, SANDSTONE, SILTSTONE, COAL
SANDSTONE, SILTSTONE, INTERMEDIATE TUFF
SANDSTONE, SILTSTONE, BASALT
LIMESTONE, BASALT
SHALE, SILTSTONE, CONGLOMERATE
BASALT, CHERT, LIMESTONE
IL'PENEY SUITE: BLUESCHIST-GREENSCHIST, BASALT, CHERT, LIMESTONE

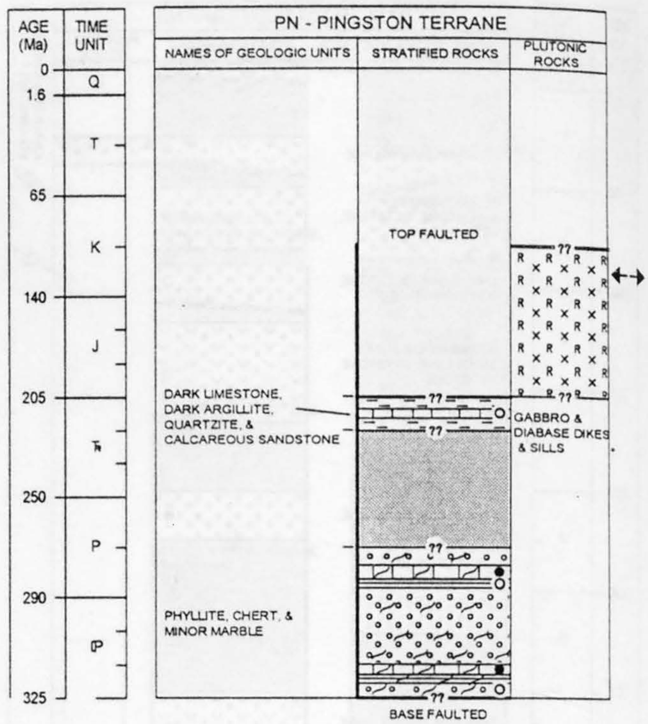
PENZHINA-ANADYR TERRANE



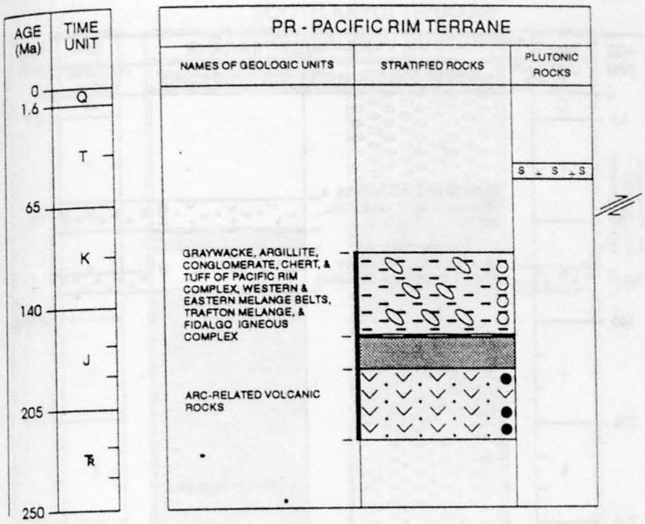


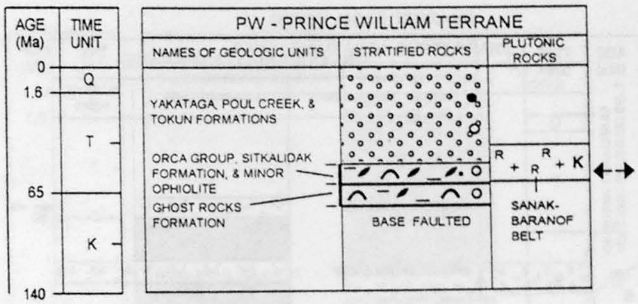


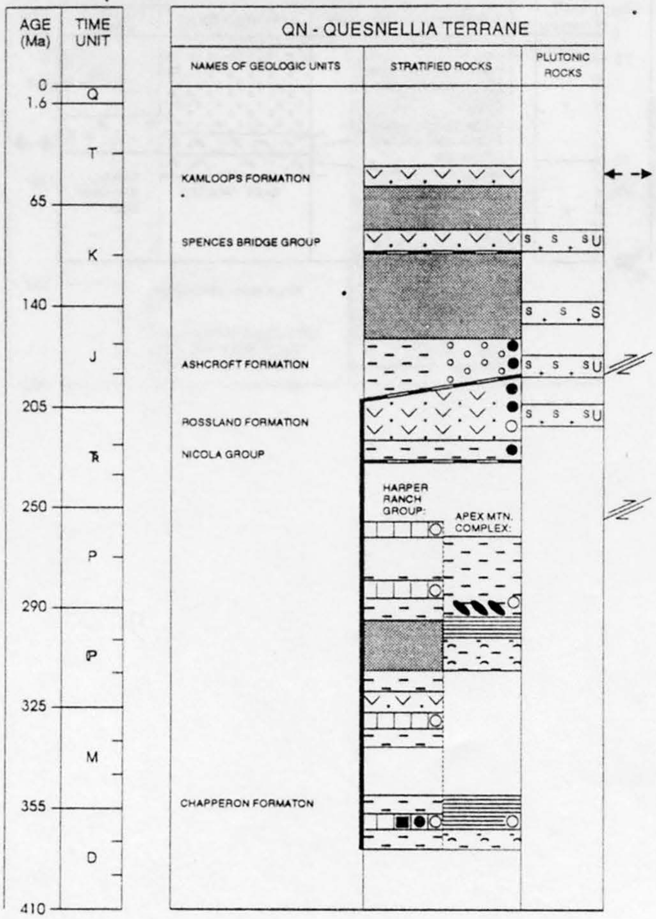
PK - PEKUL' NEY TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
Q
T
K
J
PEKULNEYVEEM SUITE
SERPENTINITE MELANGE: GLAUCOPHANE SCHIST, BASALT, AMPHIBOLITE
KAMHATKA KORYAK VOLCANIC BELT
B

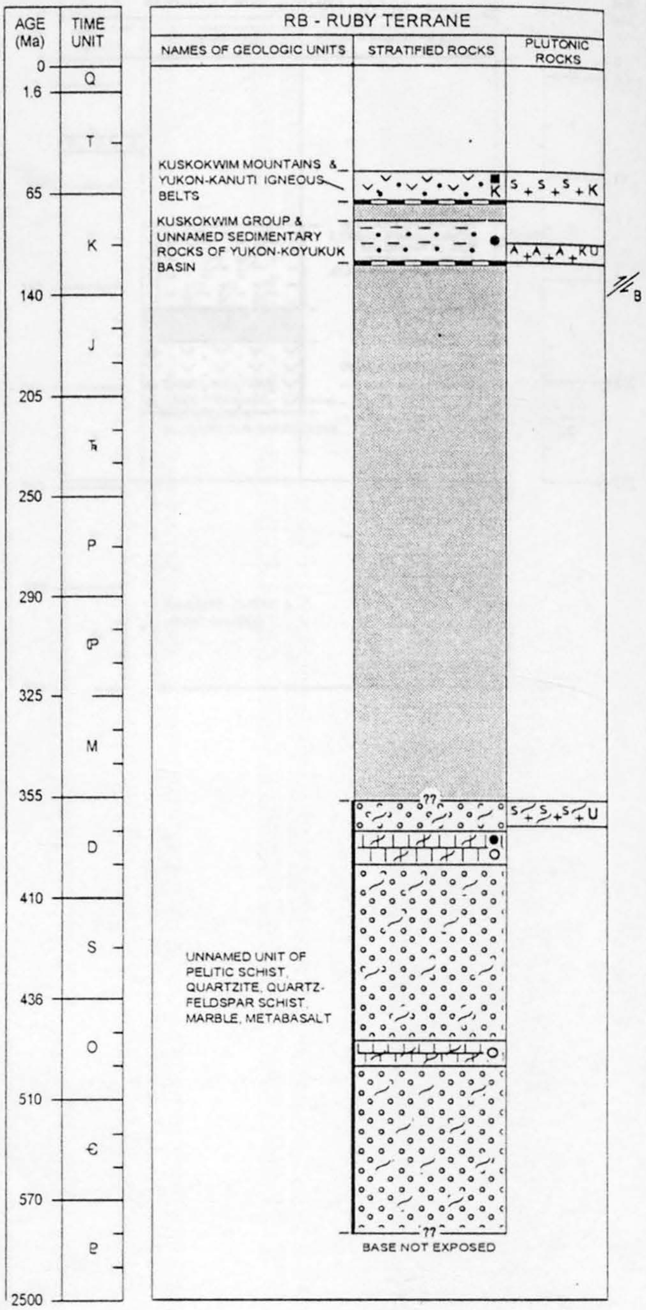


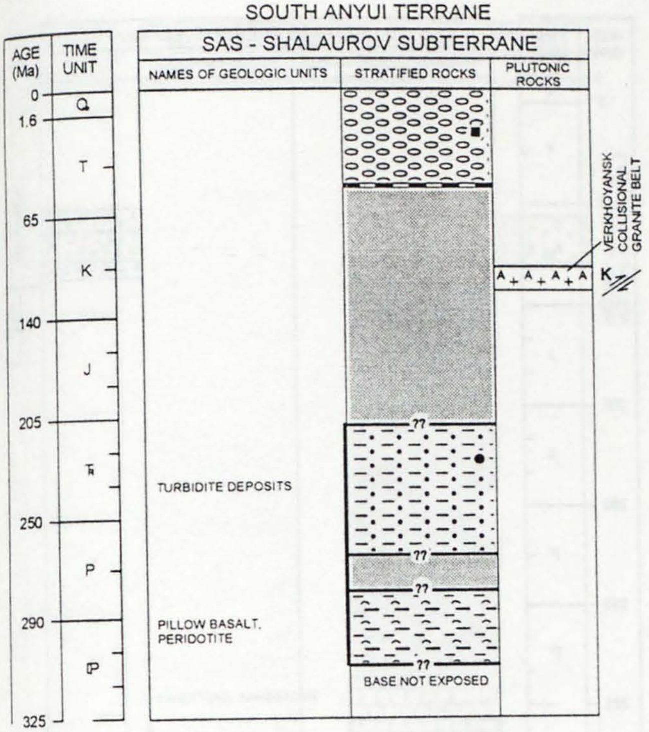
PN - PINGSTON TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
Q
T
K
J
P
TOP FAULTED
DARK LIMESTONE, DARK ARGILLITE, QUARTZITE, & CALCAREOUS SANDSTONE
GABBRO & DIABASE DIKES & SILLS
PHYLLITE, CHERT, & MINOR MARBLE
BASE FAULTED

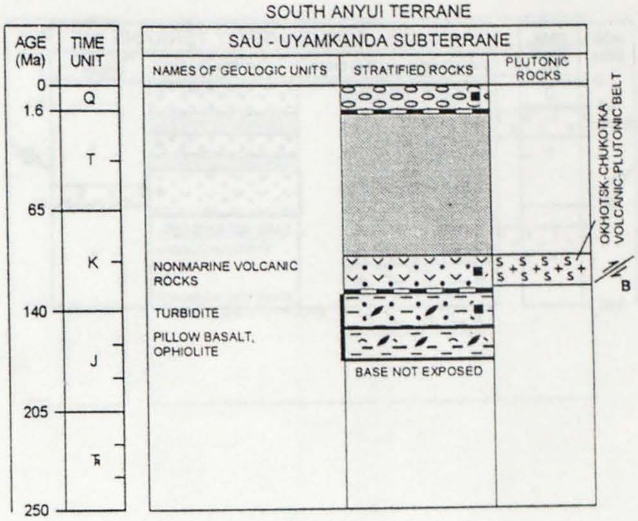

AGE (Ma)
TIME UNIT
PR - PACIFIC RIM TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
Ʀ
250
GRAYWACKE, ARGILLITE, CONGLOMERATE, CHERT, & TUFF OF PACIFIC RIM COMPLEX, WESTERN & EASTERN MELANGE BELTS, TRAFTON MELANGE, & FIDALGO IGNEOUS COMPLEX
ARC-RELATED VOLCANIC ROCKS

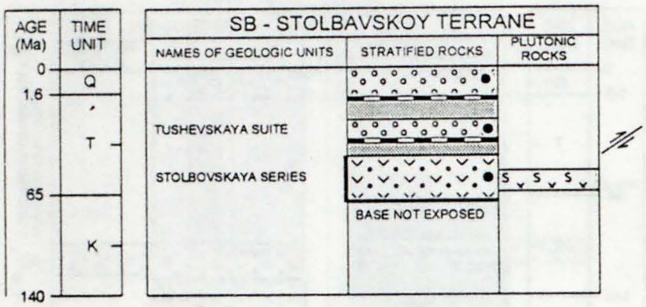

AGE (Ma)
TIME UNIT
PW - PRINCE WILLIAM TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
YAKATAGA, POUL CREEK, & TOKUN FORMATIONS
ORCA GROUP, SITKALIDAK FORMATION, & MINOR OPHIOLITE
GHOST ROCKS FORMATION
BASE FAULTED
SANAK-BARANOF BELT

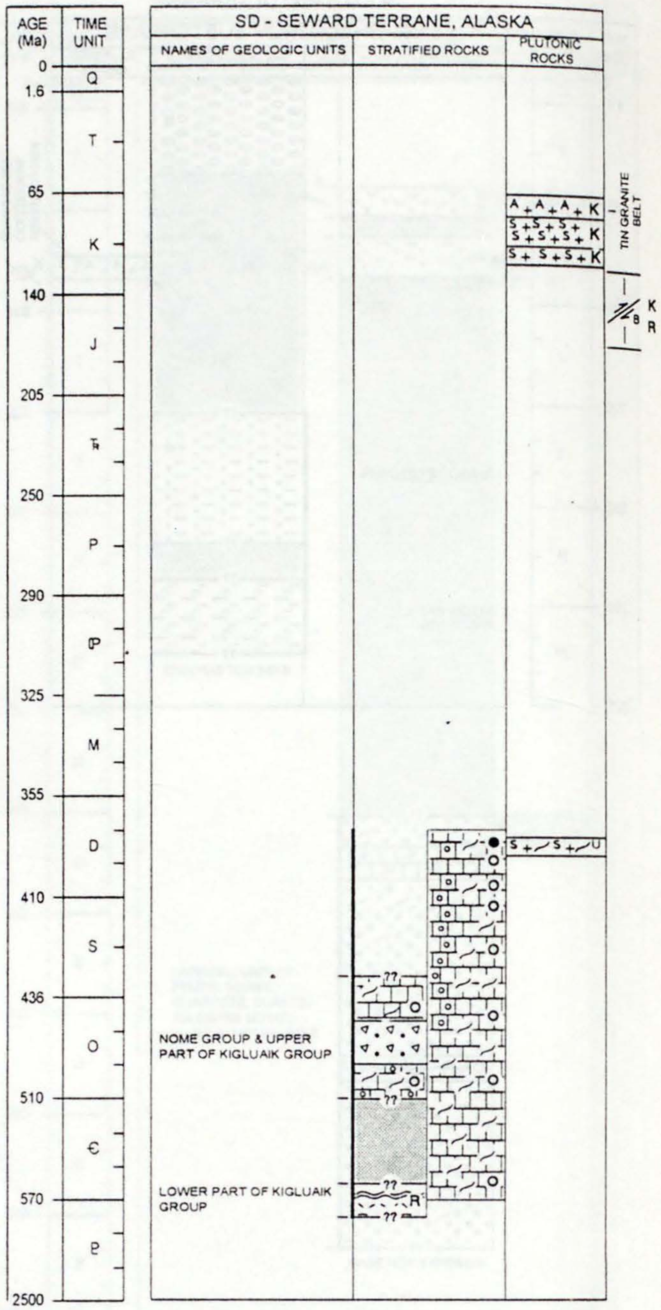

AGE (Ma)
TIME UNIT
QN - QUESNELLIA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
KAMLOOPS FORMATION
SPENCES BRIDGE GROUP
ASHCROFT FORMATION
ROSSLAND FORMATION
NICOLA GROUP
HARPER RANCH GROUP:
APEX MTN. COMPLEX:
CHAPPERON FORMATON
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
P
M
D

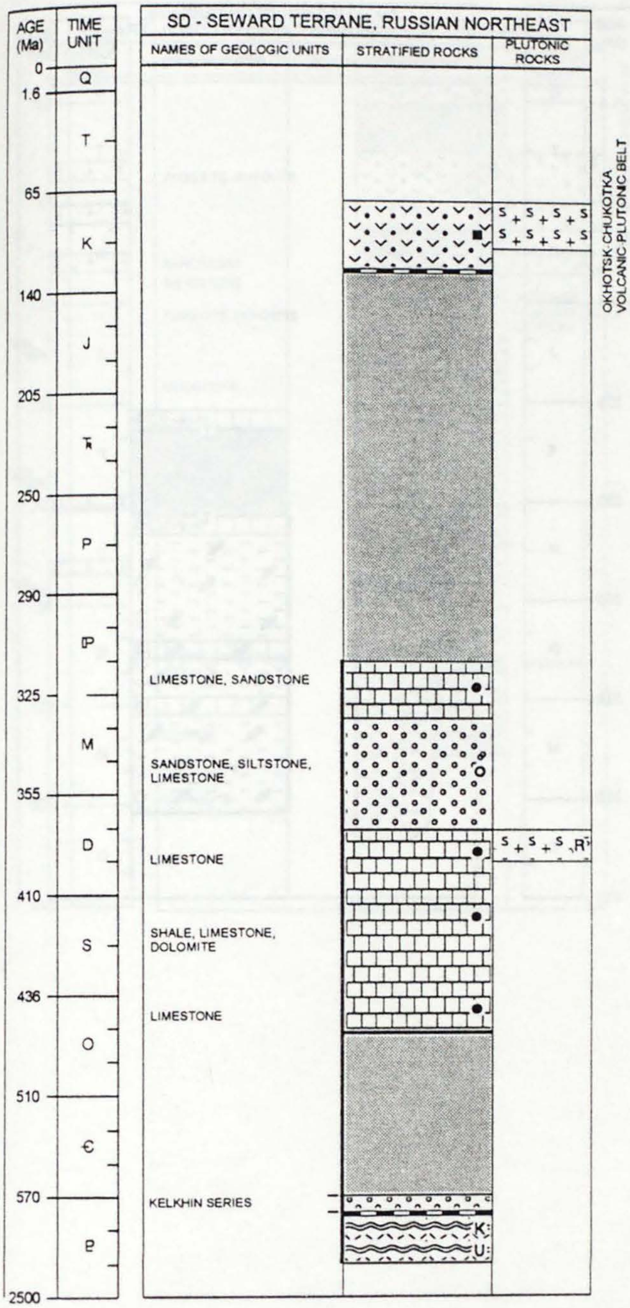

AGE (Ma)
TIME UNIT
RB - RUBY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
KUSKOKWIM MOUNTAINS & YUKON-KANUTI IGNEOUS BELTS
KUSKOKWIM GROUP & UNNAMED SEDIMENTARY ROCKS OF YUKON-KOYUKUK BASIN
UNNAMED UNIT OF PELITIC SCHIST, QUARTZITE, QUARTZ-FELDSPAR SCHIST, MARBLE, METABASALT
BASE NOT EXPOSED
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
P
M
D
S
O

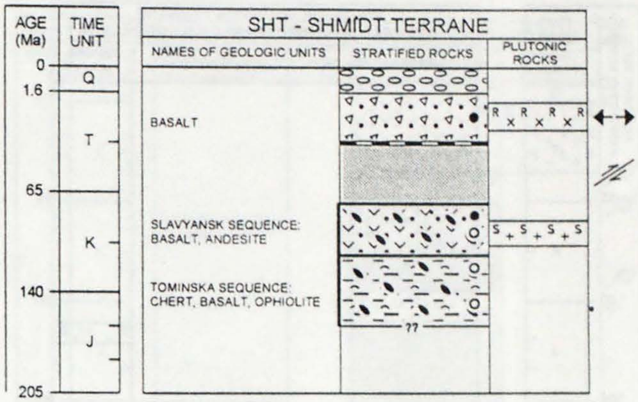

SOUTH ANYUI TERRANE
SAS - SHALAUROV SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
TURBIDITE DEPOSITS
PILLOW BASALT, PERIDOTITE
BASE NOT EXPOSED
VERKHOYANSK COLLISIONAL GRANITE BELT
K
0
1.6
65
140
205
250
290
325

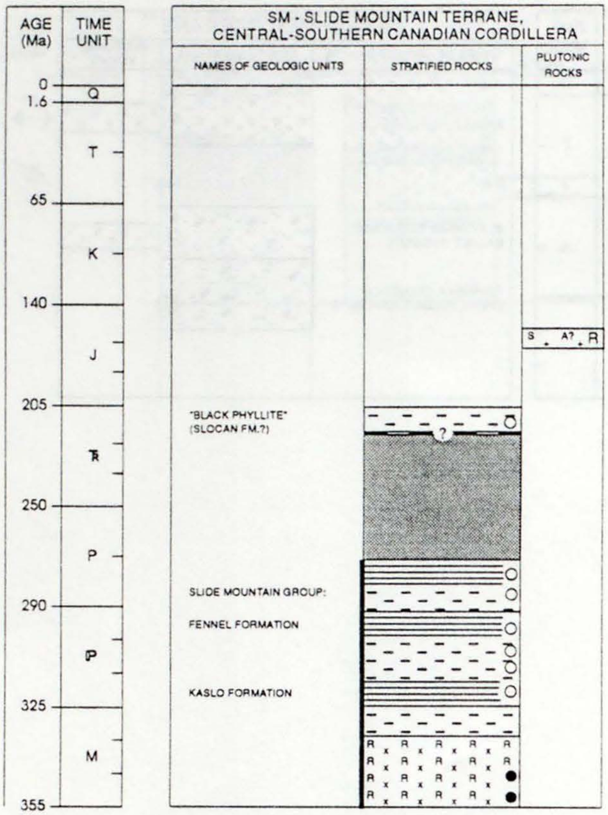

SOUTH ANYUI TERRANE
SAU - UYAMKANDA SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
NONMARINE VOLCANIC ROCKS
TURBIDITE
PILLOW BASALT, OPHIOLITE
BASE NOT EXPOSED
OKHOTSK-CHUKOTKA VOLCANIC-PLUTONIC BELT
B
0
1.6
65
140
205
250

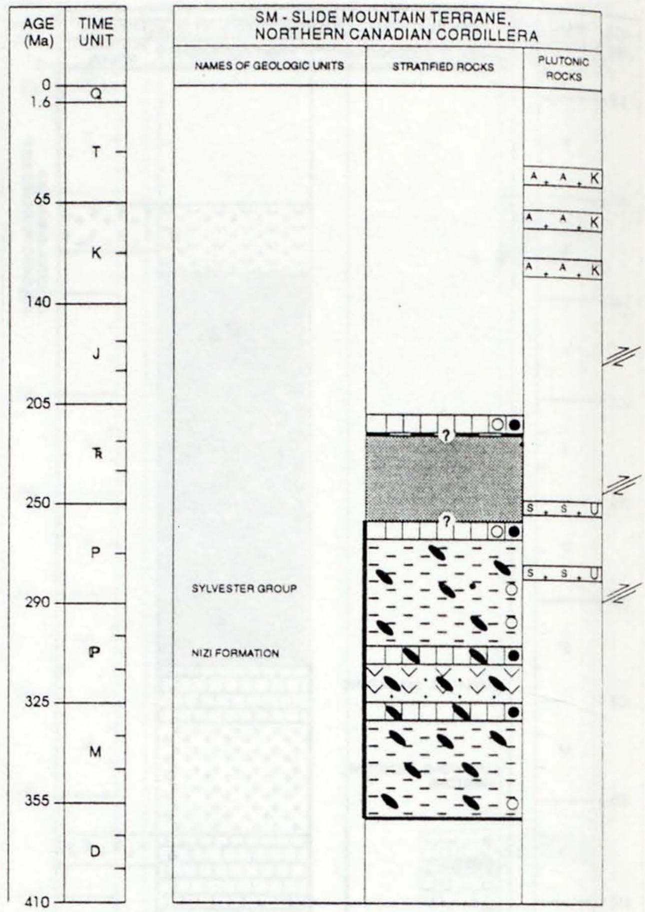

SB - STOLBAVSKOY TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
TUSHEVSKAYA SUITE
STOLBOVSKAYA SERIES
BASE NOT EXPOSED

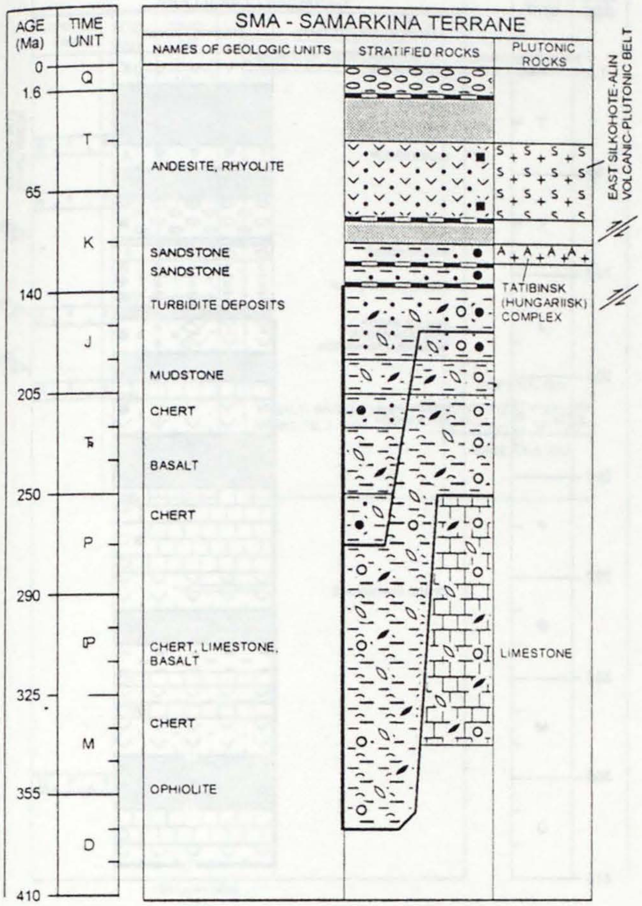

SD - SEWARD TERRANE, ALASKA
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
TIN GRANITE BELT
NOME GROUP & UPPER PART OF KIGLUAIK GROUP
LOWER PART OF KIGLUAIK GROUP


AGE (Ma)
TIME UNIT
SD - SEWARD TERRANE, RUSSIAN NORTHEAST
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
250
P
290
325
M
355
D
410
S
436
O
510
570
2500
OKHOTSK CHUKOTKA VOLCANIC PLUTONIC BELT
LIMESTONE, SANDSTONE
SANDSTONE, SILTSTONE, LIMESTONE
LIMESTONE
SHALE, LIMESTONE, DOLOMITE
LIMESTONE
KELKHIN SERIES

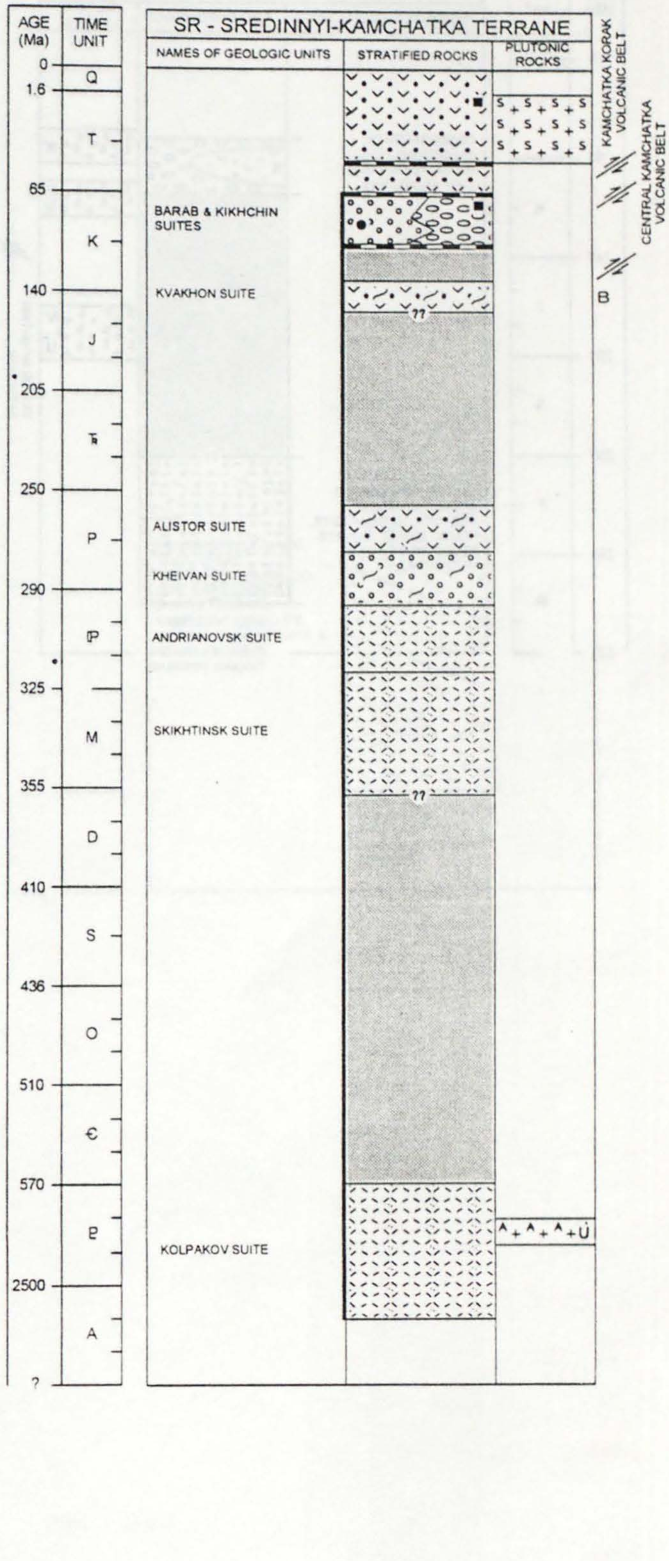

AGE (Ma)
TIME UNIT
SHT - SHMIDT TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
BASALT
SLAVYANSK SEQUENCE: BASALT, ANDESITE
TOMINSKA SEQUENCE: CHERT, BASALT, OPHIOLITE
??


AGE (Ma)
TIME UNIT
SM - SLIDE MOUNTAIN TERRANE, CENTRAL-SOUTHERN CANADIAN CORDILLERA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
Q
T
K
J
P
M
"BLACK PHYLLITE" (SLOCAN FM.?)
SLIDE MOUNTAIN GROUP:
FENNEL FORMATION
KASLO FORMATION

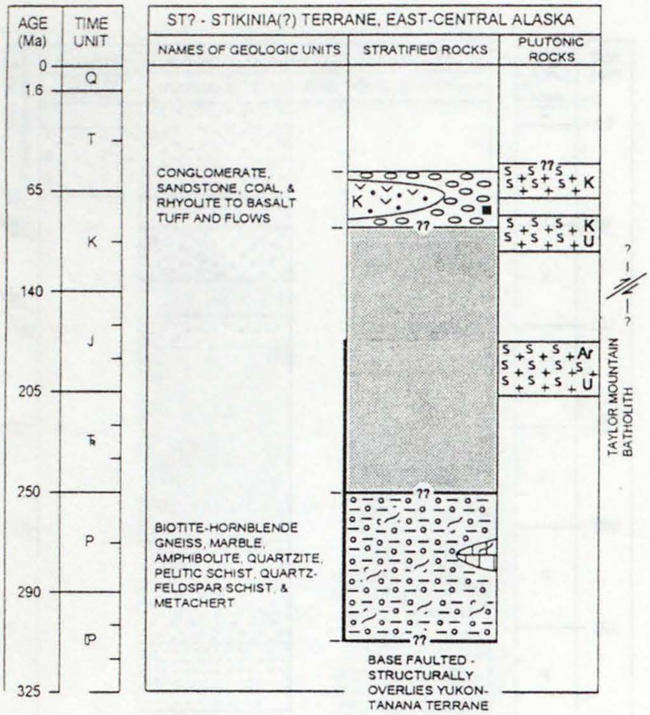

AGE (Ma)
TIME UNIT
SM - SLIDE MOUNTAIN TERRANE, NORTHERN CANADIAN CORDILLERA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
P
M
D
SYLVESTER GROUP
NIZI FORMATION

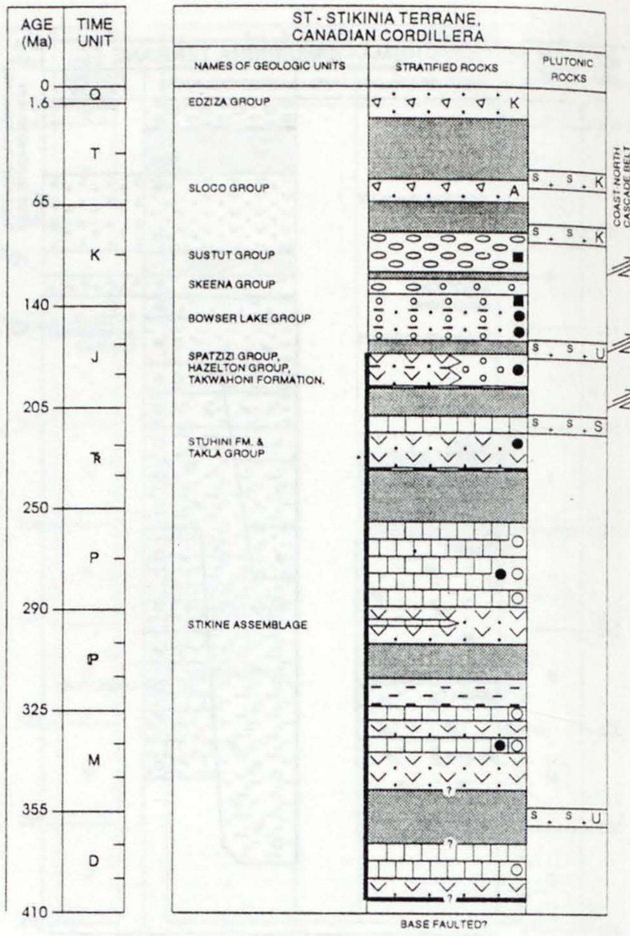


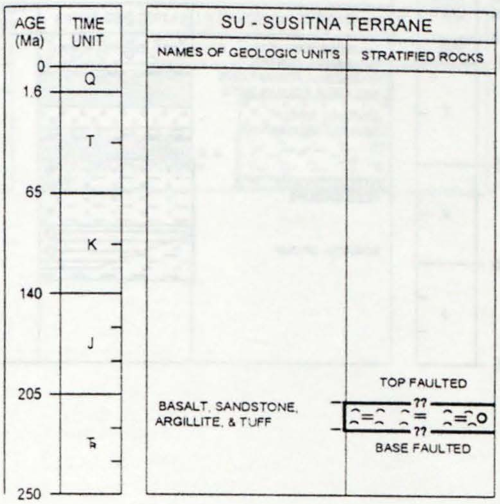
AGE (Ma)
TIME UNIT
SMA - SAMARKINA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
ANDESITE, RHYOLITE
SANDSTONE
SANDSTONE
TURBIDITE DEPOSITS
MUDSTONE
CHERT
BASALT
CHERT
CHERT, LIMESTONE, BASALT
CHERT
OPHIOLITE
TATIBINSK (HUNGARIISK) COMPLEX
LIMESTONE
EAST SILKHOTE-ALIN VOLCANIC-PLUTONIC BELT

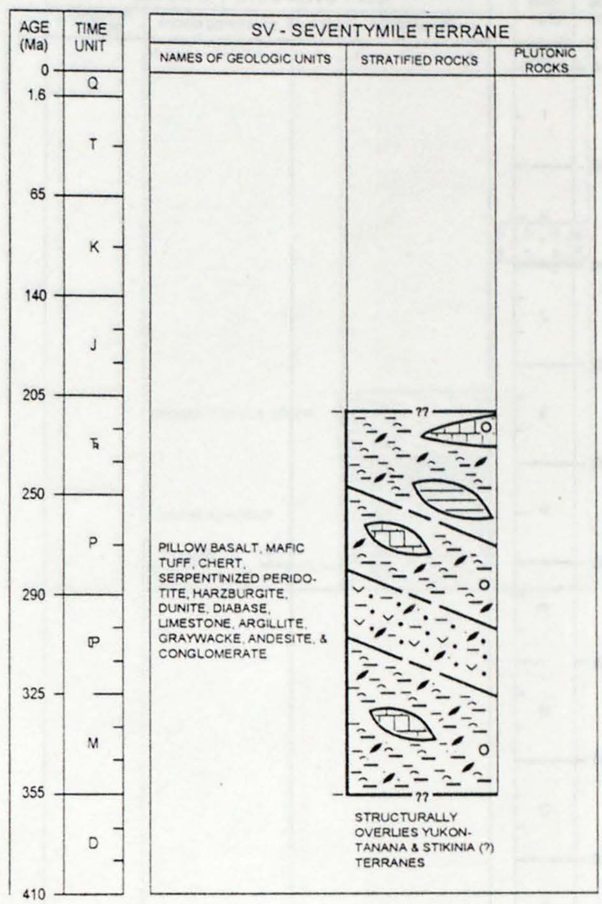


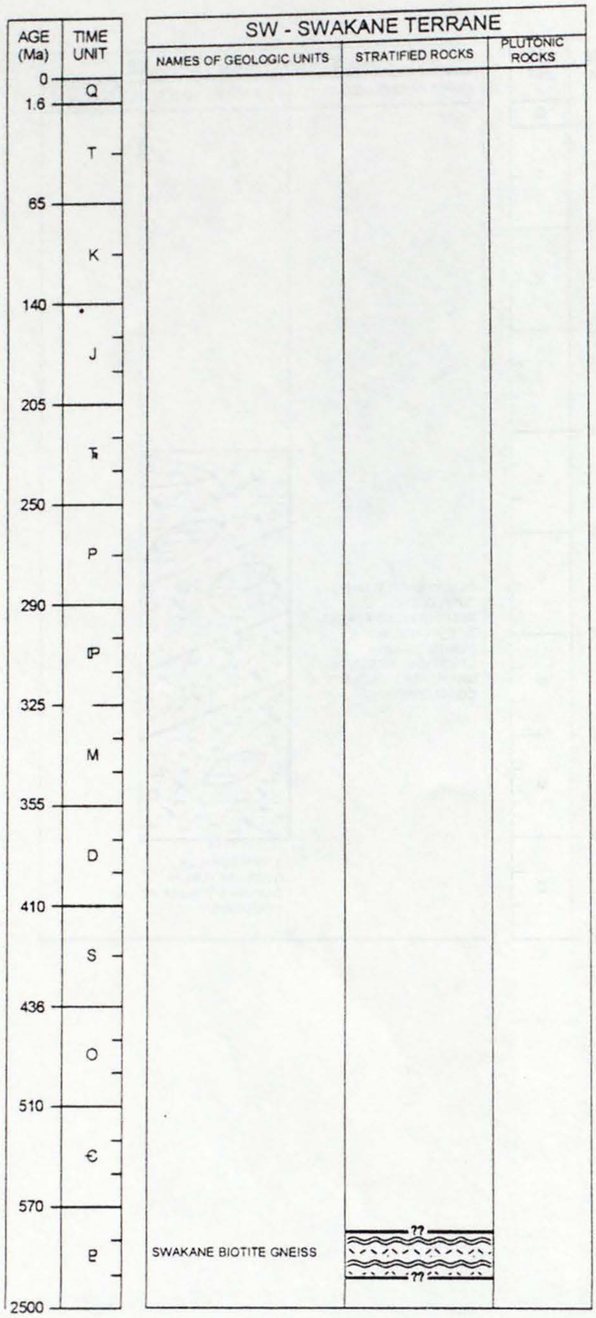
AGE (Ma)
TIME UNIT
SR - SREDINNYI-KAMCHATKA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
BARAB & KIKHCHIN SUITES
KVAKHON SUITE
ALISTOR SUITE
KHEIVAN SUITE
ANDRIANOVSK SUITE
SKIKHTINSK SUITE
KOLPAKOV SUITE
KAMCHATKA KORAK VOLCANIC BELT
CENTRAL KAMCHATKA VOLCANIC BELT
B

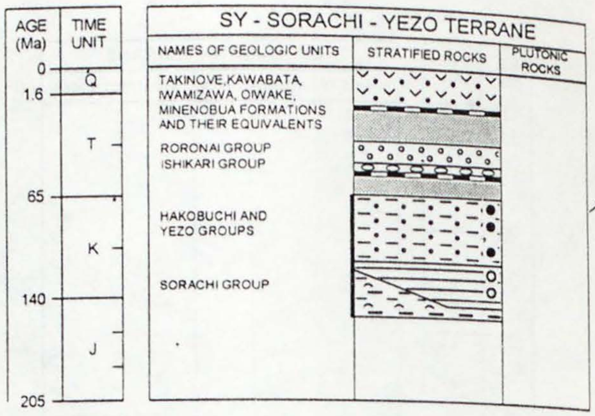

AGE (Ma)
TIME UNIT
ST? - STIKINIA(?) TERRANE, EAST-CENTRAL ALASKA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
CONGLOMERATE, SANDSTONE, COAL, & RHYOLITE TO BASALT TUFF AND FLOWS
BIOTITE-HORNBLENDE GNEISS, MARBLE, AMPHIBOLITE, QUARTZITE, PELITIC SCHIST, QUARTZ-FELDSPAR SCHIST, & METACHERT
BASE FAULTED - STRUCTURALLY OVERLIES YUKON-TANANA TERRANE
TAYLOR MOUNTAIN BATHOLITH

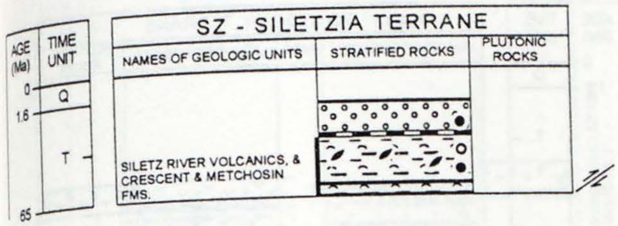

AGE (Ma)
TIME UNIT
ST - STIKINIA TERRANE, CANADIAN CORDILLERA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
EDZIZA GROUP
SLOCO GROUP
SUSTUT GROUP
SKEENA GROUP
BOWSER LAKE GROUP
SPATZIZI GROUP, HAZELTON GROUP, TAKWAHONI FORMATION.
STUHINI FM. & TAKLA GROUP
STIKINE ASSEMBLAGE
COAST NORTH CASCADE BELT
BASE FAULTED?


AGE (Ma)
TIME UNIT
SU - SUSITNA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
0
1.6
Q
T
65
K
140
J
205
Ћ
250
TOP FAULTED
??
BASALT, SANDSTONE, ARGILLITE, & TUFF
??
BASE FAULTED

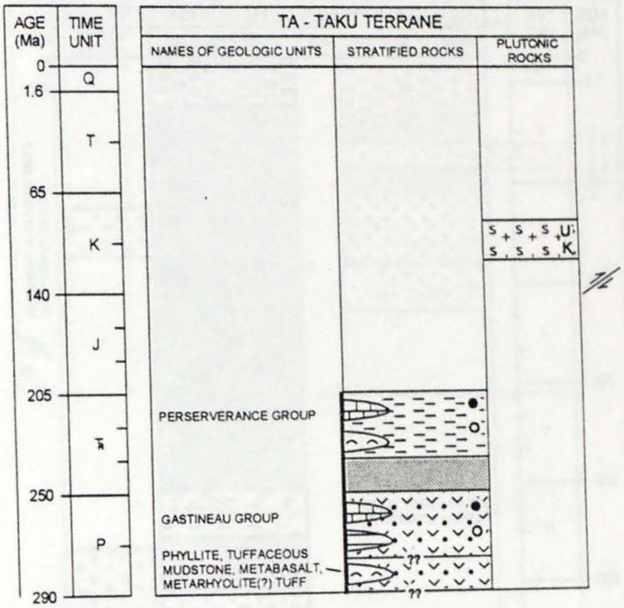

AGE (Ma)
TIME UNIT
SV - SEVENTYMILE TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
Ћ
250
P
290
IP
325
M
355
D
410
??
PILLOW BASALT, MAFIC TUFF, CHERT, SERPENTINIZED PERIDOTITE, HARZBURGITE, DUNITE, DIABASE, LIMESTONE, ARGILLITE, GRAYWACKE, ANDESITE, & CONGLOMERATE
??
STRUCTURALLY OVERLIES YUKON-TANANA & STIKINIA (?) TERRANES


SW - SWAKANE TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
P
M
D
S
O
SWAKANE BIOTITE GNEISS
??

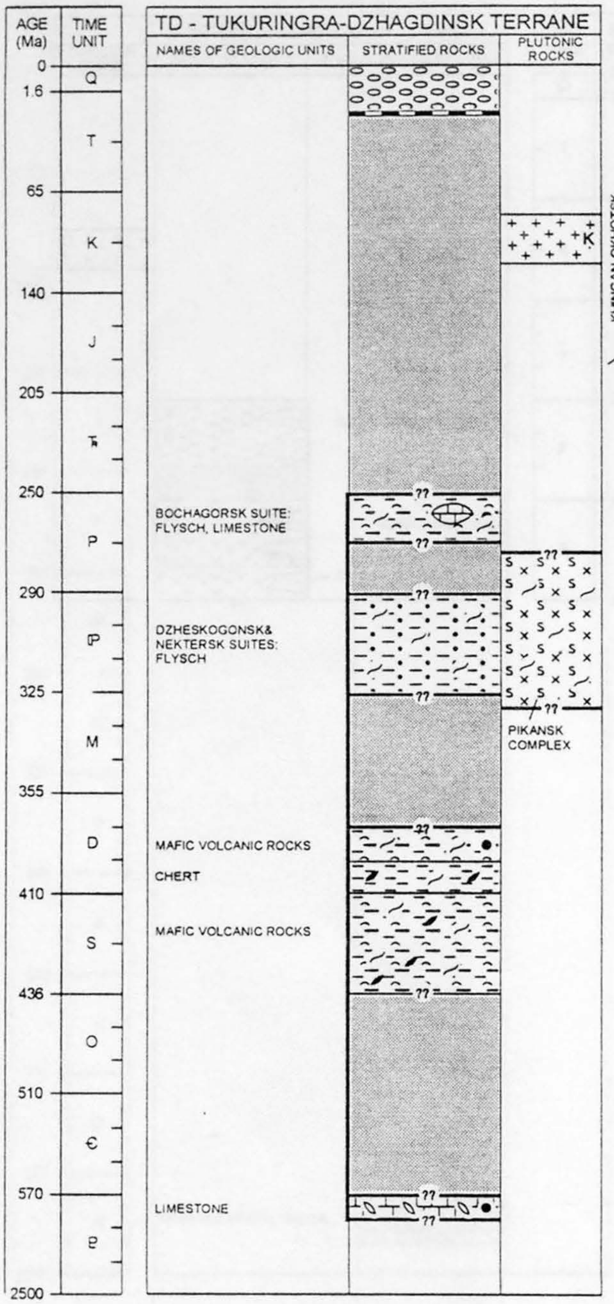

SY - SORACHI - YEZO TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
Q
T
K
J
TAKINOVE, KAWABATA, IWAMIZAWA, OIWAKE, MINENOBUA FORMATIONS AND THEIR EQUIVALENTS
RORONAI GROUP
ISHIKARI GROUP
HAKOBUCHI AND YEZO GROUPS
SORACHI GROUP

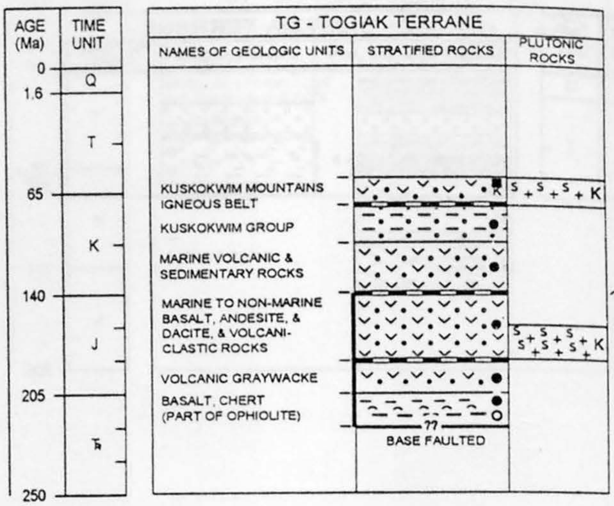


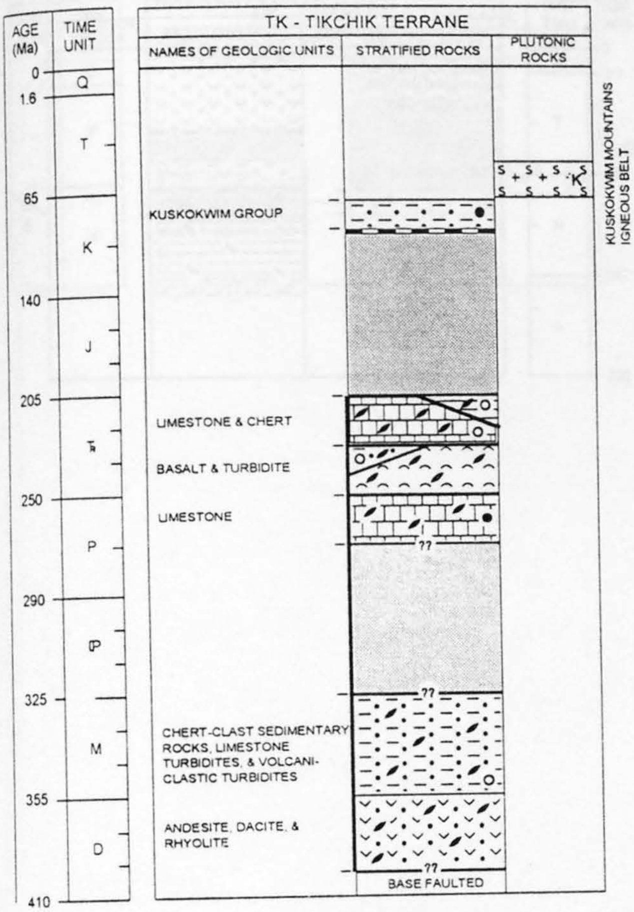
SZ - SILETZIA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
Q
T
SILETZ RIVER VOLCANICS, & CRESCENT & METCHOSIN FMS.

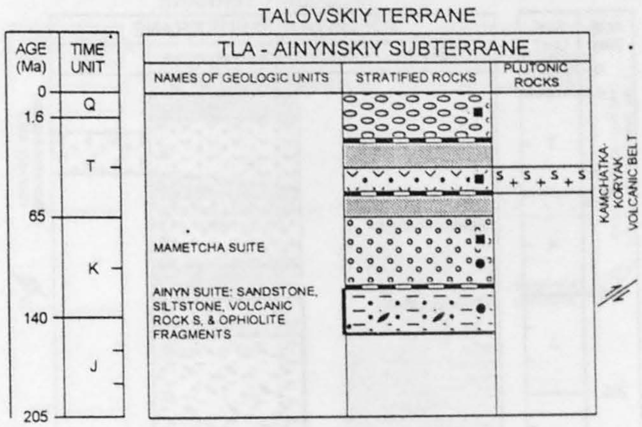


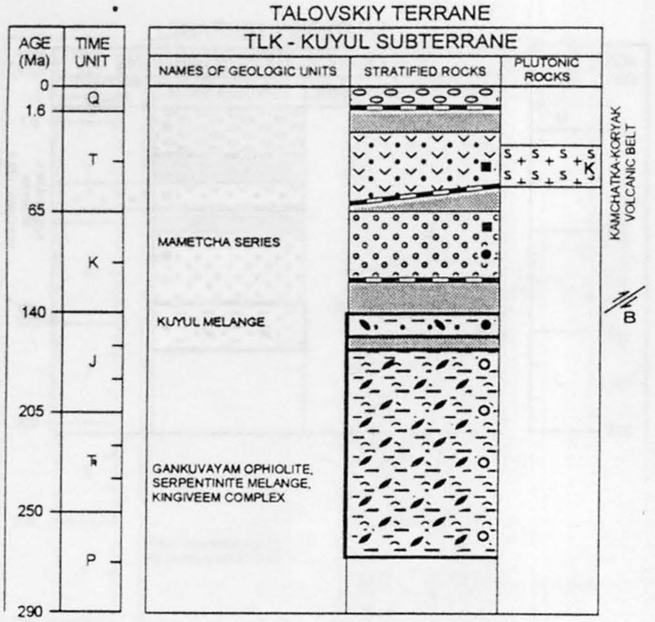
TA - TAKU TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
Q
T
K
J
P
PERSERVERANCE GROUP
GASTINEAU GROUP
PHYLLITE, TUFFACEOUS MUDSTONE, METABASALT, METARHYOLITE(?) TUFF

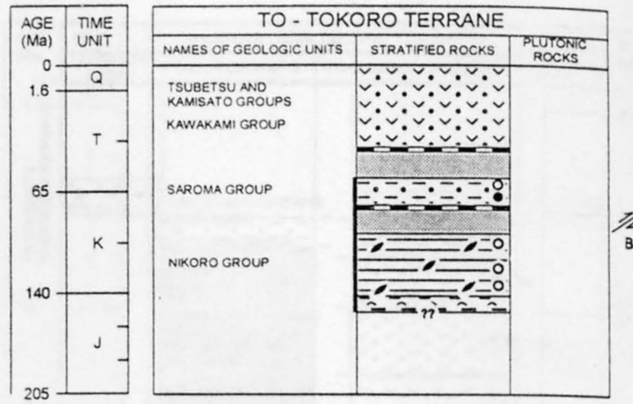

AGE (Ma)
TIME UNIT
TD - TUKURINGRA-DZHAGDINSK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
Ꞧ
P
ꟼ
M
D
S
O
€
Ᵽ
KHINGAN-OKHOTSK VOLCANIC-PLUTONIC BELT
B
BOCHAGORSK SUITE: FLYSCH, LIMESTONE
DZHESKOGONSK& NEKTERSK SUITES: FLYSCH
PIKANSK COMPLEX
MAFIC VOLCANIC ROCKS
CHERT
MAFIC VOLCANIC ROCKS
LIMESTONE

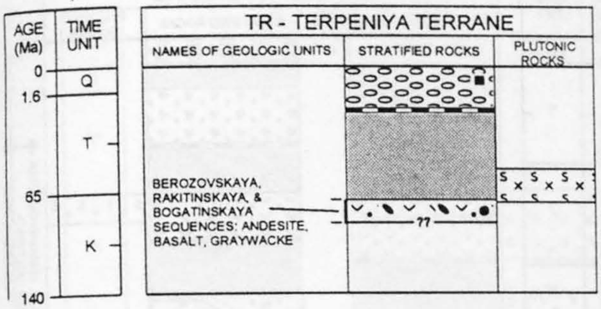

AGE (Ma)
TIME UNIT
TG - TOGIAK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
Ꞧ
KUSKOKWIM MOUNTAINS IGNEOUS BELT
KUSKOKWIM GROUP
MARINE VOLCANIC & SEDIMENTARY ROCKS
MARINE TO NON-MARINE BASALT, ANDESITE, & DACITE, & VOLCANI-CLASTIC ROCKS
VOLCANIC GRAYWACKE
BASALT, CHERT (PART OF OPHIOLITE)
BASE FAULTED
KOYUKUK ARC?

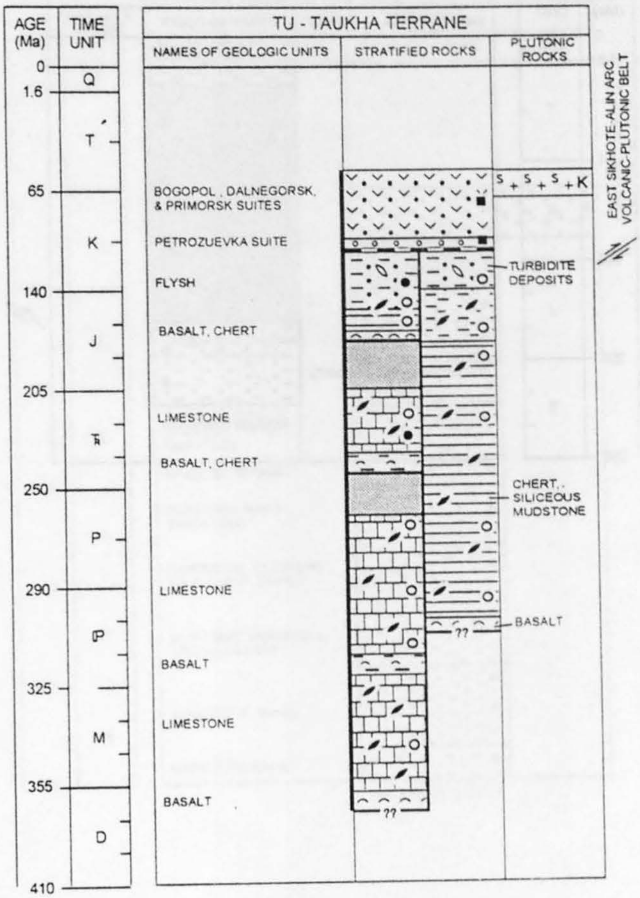

AGE (Ma)
TIME UNIT
TK - TIKCHIK TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
KUSKOKWIM MOUNTAINS IGNEOUS BELT
KUSKOKWIM GROUP
LIMESTONE & CHERT
BASALT & TURBIDITE
LIMESTONE
CHERT-CLAST SEDIMENTARY ROCKS, LIMESTONE TURBIDITES, & VOLCANICLASTIC TURBIDITES
ANDESITE, DACITE, & RHYOLITE
BASE FAULTED
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
P
M
D

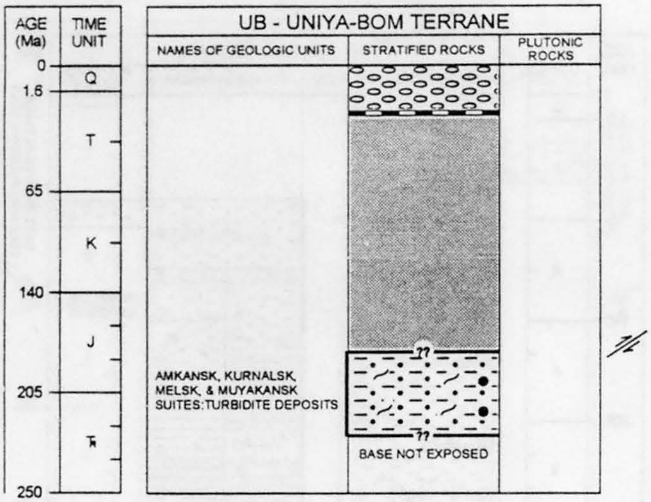

TALOVSKIY TERRANE
AGE (Ma)
TIME UNIT
TLA - AINYNSKIY SUBTERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
KAMCHATKA-KORYAK VOLCANIC BELT
MAMETCHA SUITE
AINYN SUITE: SANDSTONE, SILTSTONE, VOLCANIC ROCK S, & OPHIOLITE FRAGMENTS
0
1.6
65
140
205
Q
T
K
J

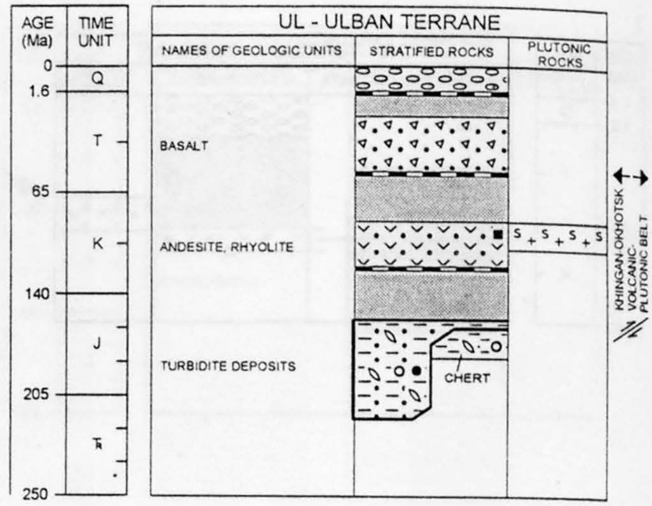

TALOVSKIY TERRANE
TLK - KUYUL SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
Q
T
K
J
P
MAMETCHA SERIES
KUYUL MELANGE
GANKUVAYAM OPHIOLITE, SERPENTINITE MELANGE, KINGIVEEM COMPLEX
KAMCHATKA-KORYAK VOLCANIC BELT
K
B

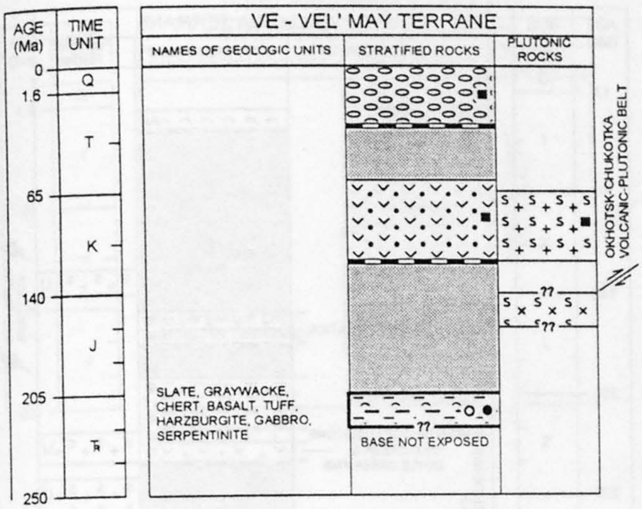

TO - TOKORO TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
Q
T
K
J
TSUBETSU AND KAMISATO GROUPS
KAWAKAMI GROUP
SAROMA GROUP
NIKORO GROUP
??
B


AGE (Ma)
TIME UNIT
TR - TERPENIYA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
Q
T
K
BEROZOVSKAYA, RAKITINSKAYA, & BOGATINSKAYA SEQUENCES: ANDESITE, BASALT, GRAYWACKE
??

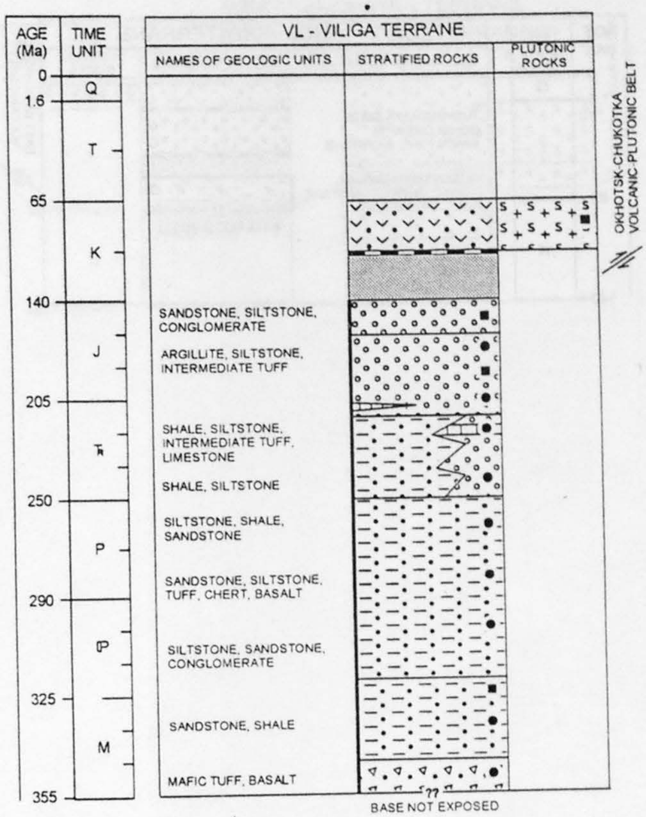

AGE (Ma)
TIME UNIT
TU - TAUKHA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
Q
T
K
J
P
M
D
BOGOPOL, DALNEGORSK, & PRIMORSK SUITES
PETROZUEVKA SUITE
FLYSH
BASALT, CHERT
LIMESTONE
BASALT, CHERT
LIMESTONE
BASALT
LIMESTONE
BASALT
TURBIDITE DEPOSITS
CHERT, SILICEOUS MUDSTONE
BASALT
??
EAST SIKHOTE-ALIN ARC VOLCANIC-PLUTONIC BELT


UB - UNIYA-BOM TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
Ћ
AMKANSK, KURNALSK, MELSK, & MUYAKANSK SUITES:TURBIDITE DEPOSITS
??
BASE NOT EXPOSED

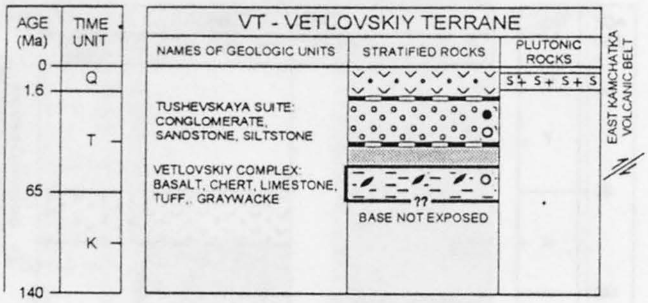

UL - ULBAN TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
Q
T
K
J
Ћ
BASALT
ANDESITE, RHYOLITE
TURBIDITE DEPOSITS
CHERT
KHINGAN-OKHOTSK VOLCANIC-PLUTONIC BELT

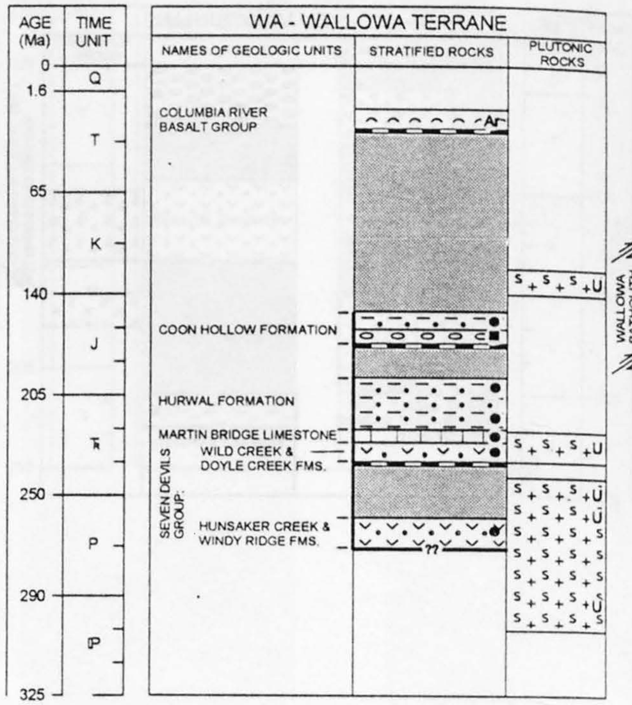


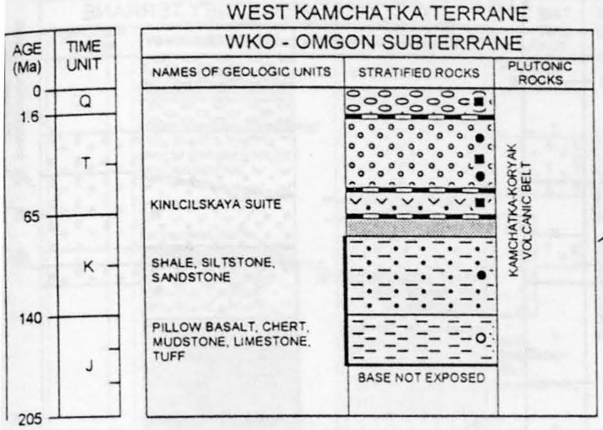
AGE (Ma)
TIME UNIT
VE - VEL' MAY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
Q
1.6
T
65
K
140
J
205
Ŧ
250
SLATE, GRAYWACKE, CHERT, BASALT, TUFF, HARZBURGITE, GABBRO, SERPENTINITE
BASE NOT EXPOSED
OKHOTSK-CHUKOTKA VOLCANIC-PLUTONIC BELT

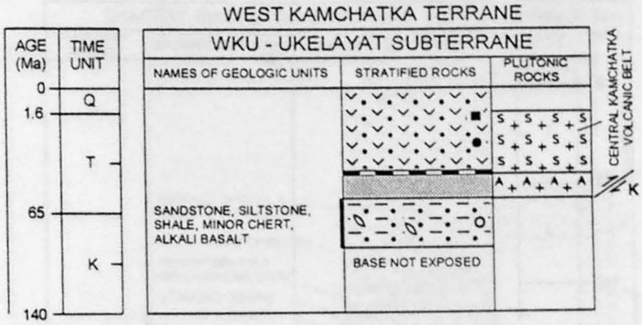


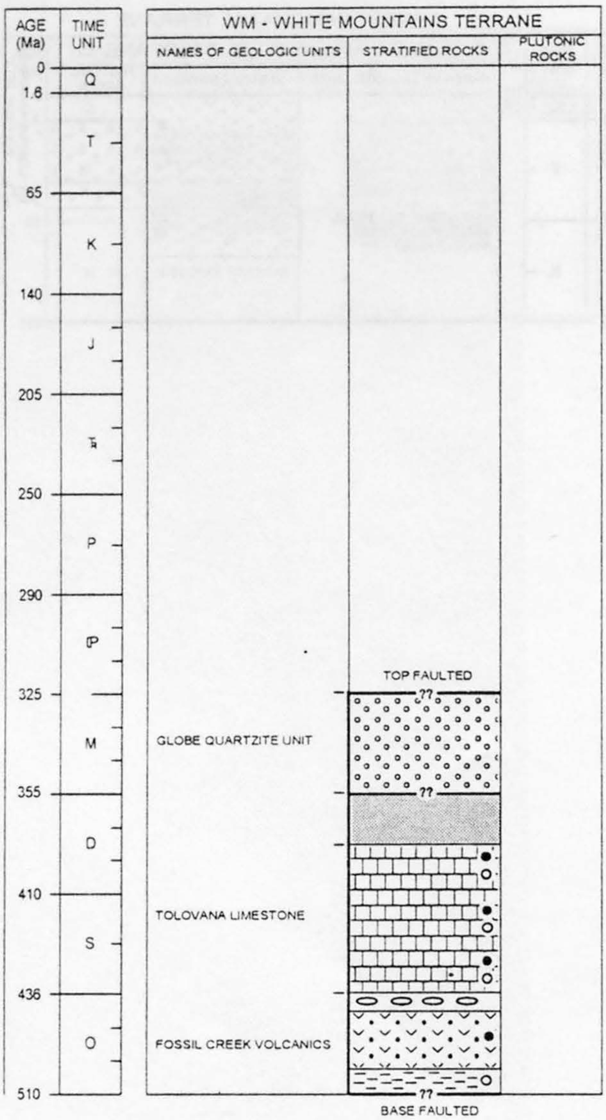
AGE (Ma)
TIME UNIT
VL - VILIGA TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
Q
1.6
T
65
K
140
J
205
Ŧ
250
P
290
IP
325
M
355
SANDSTONE, SILTSTONE, CONGLOMERATE
ARGILLITE, SILTSTONE, INTERMEDIATE TUFF
SHALE, SILTSTONE, INTERMEDIATE TUFF, LIMESTONE
SHALE, SILTSTONE
SILTSTONE, SHALE, SANDSTONE
SANDSTONE, SILTSTONE, TUFF, CHERT, BASALT
SILTSTONE, SANDSTONE, CONGLOMERATE
SANDSTONE, SHALE
MAFIC TUFF, BASALT
BASE NOT EXPOSED
OKHOTSK-CHUKOTKA VOLCANIC-PLUTONIC BELT

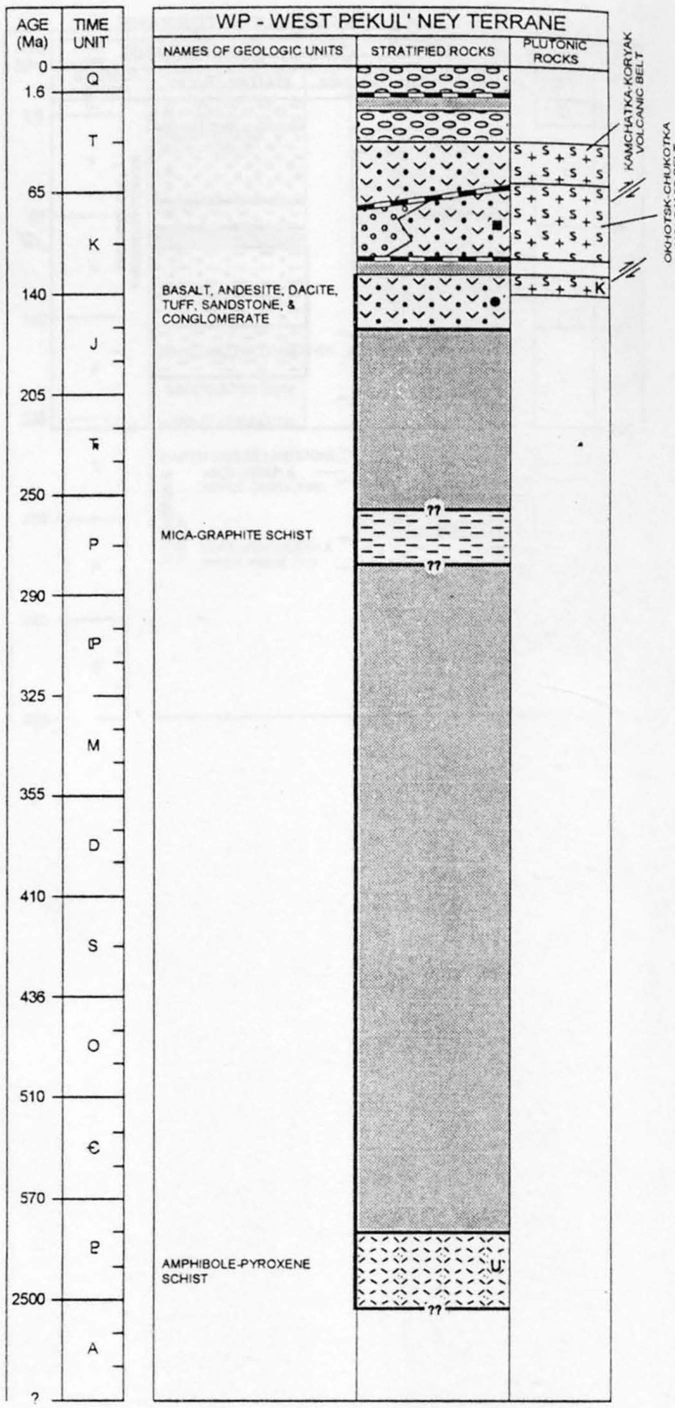

VT - VETLOVSKIY TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
Q
T
K
TUSHEVSKAYA SUITE: CONGLOMERATE, SANDSTONE, SILTSTONE
VETLOVSKIY COMPLEX: BASALT, CHERT, LIMESTONE, TUFF,, GRAYWACKE
BASE NOT EXPOSED
EAST KAMCHATKA VOLCANIC BELT


WA - WALLOWA TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
Q
T
K
J
Ŧ
P
IP
COLUMBIA RIVER BASALT GROUP
COON HOLLOW FORMATION
HURWAL FORMATION
MARTIN BRIDGE LIMESTONE
WILD CREEK & DOYLE CREEK FMS.
SEVEN DEVILS GROUP
HUNSAKER CREEK & WINDY RIDGE FMS.
WALLOWA BATHOLITH

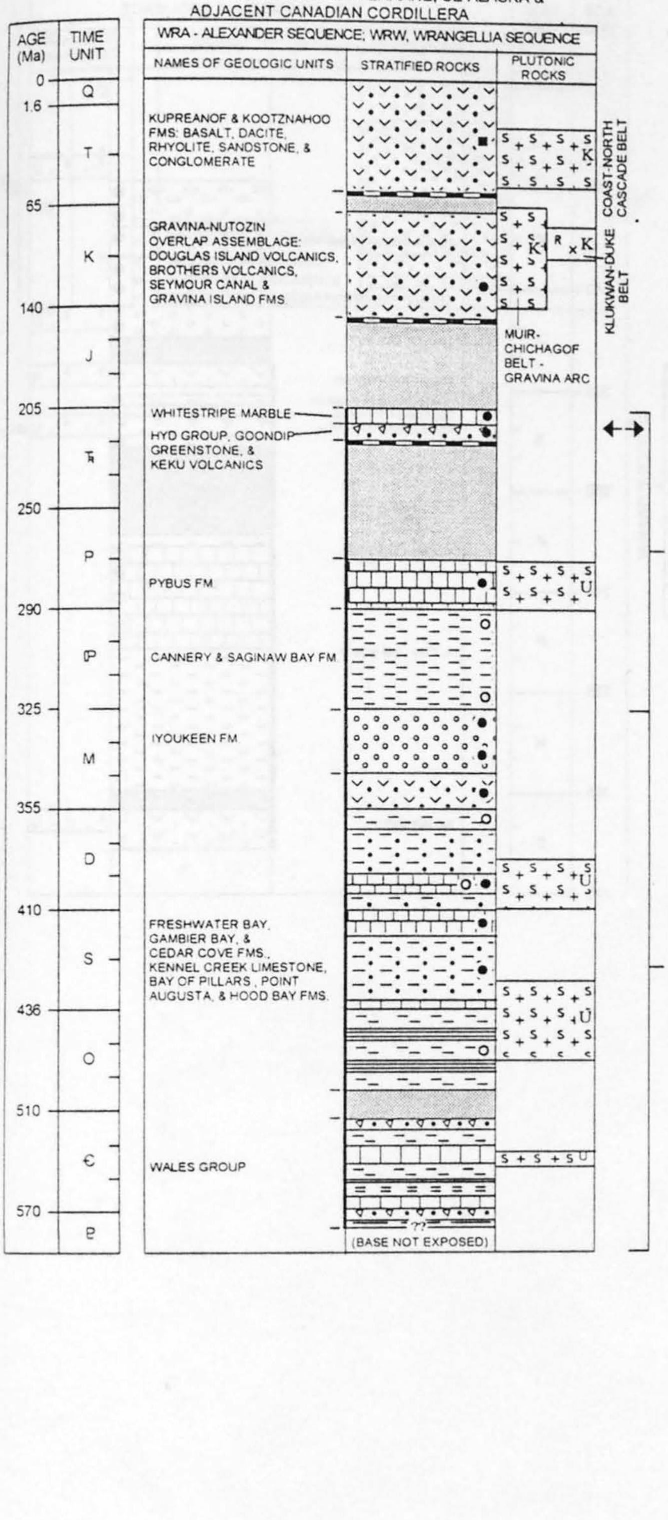

WEST KAMCHATKA TERRANE
WKO - OMGON SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
KINLCILSKAYA SUITE
SHALE, SILTSTONE, SANDSTONE
PILLOW BASALT, CHERT, MUDSTONE, LIMESTONE, TUFF
BASE NOT EXPOSED
KAMCHATKA-KORYAK VOLCANIC BELT


WEST KAMCHATKA TERRANE
WKU - UKELAYAT SUBTERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
SANDSTONE, SILTSTONE, SHALE, MINOR CHERT, ALKALI BASALT
BASE NOT EXPOSED
CENTRAL KAMCHATKA VOLCANIC BELT
K

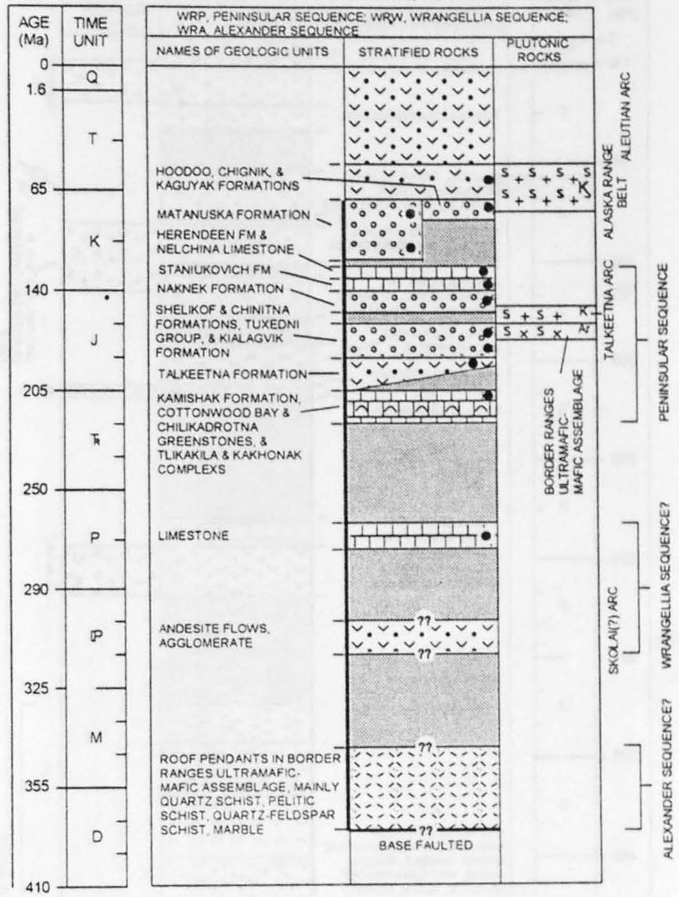

WM - WHITE MOUNTAINS TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
Q
T
K
J
P
M
D
S
O
TOP FAULTED
GLOBE QUARTZITE UNIT
TOLOVANA LIMESTONE
FOSSIL CREEK VOLCANICS
BASE FAULTED

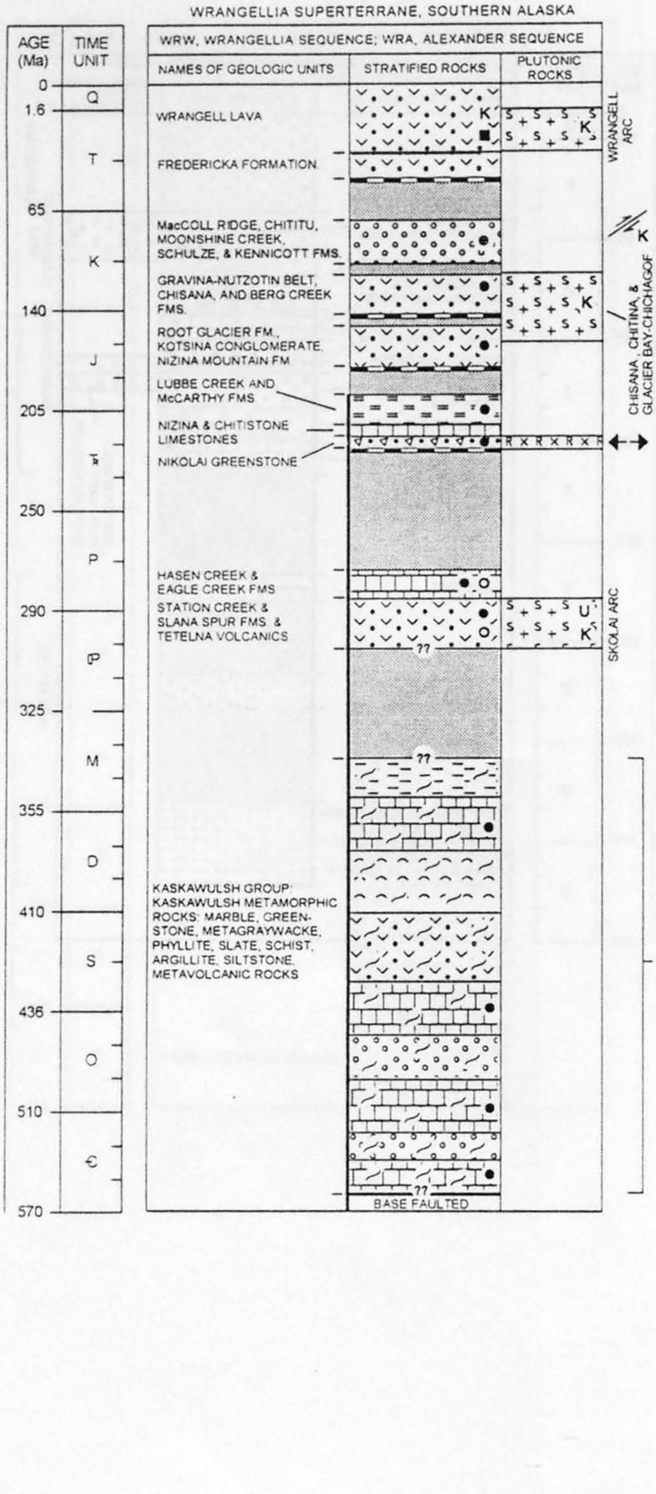

WP - WEST PEKUL' NEY TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
?
Q
T
K
J
P
M
D
S
O
A
BASALT, ANDESITE, DACITE, TUFF, SANDSTONE, & CONGLOMERATE
MICA-GRAPHITE SCHIST
AMPHIBOLE-PYROXENE SCHIST
KAMCHATKA-KORYAK VOLCANIC BELT
OKHOTSK-CHUKOTKA VOLCANIC BELT

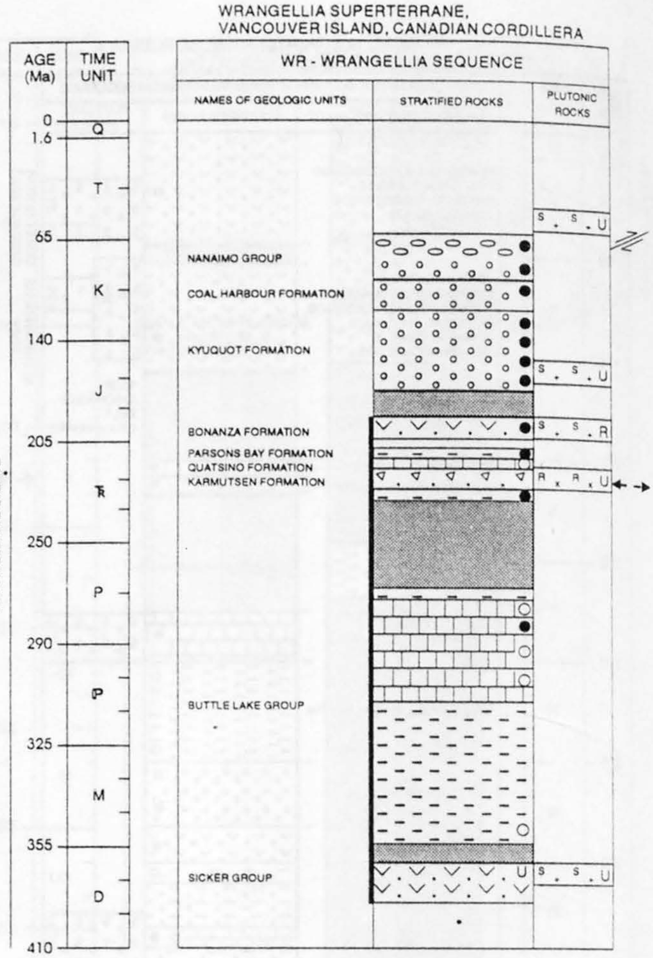
WRANGELLIA SUPERTERRANE, SE ALASKA & ADJACENT CANADIAN CORDILLERA

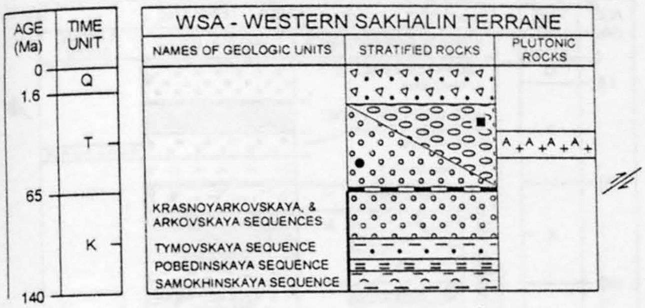


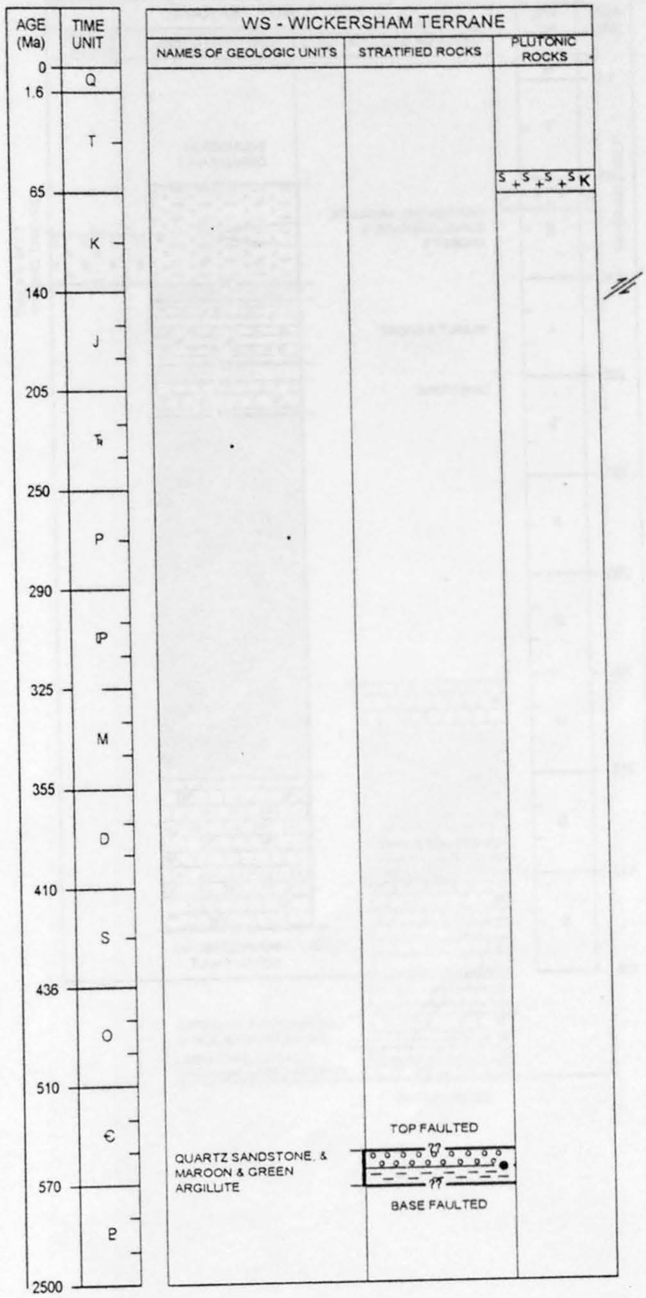
WRANGELLIA SUPERTERRANE, ALASKA PENINSULA

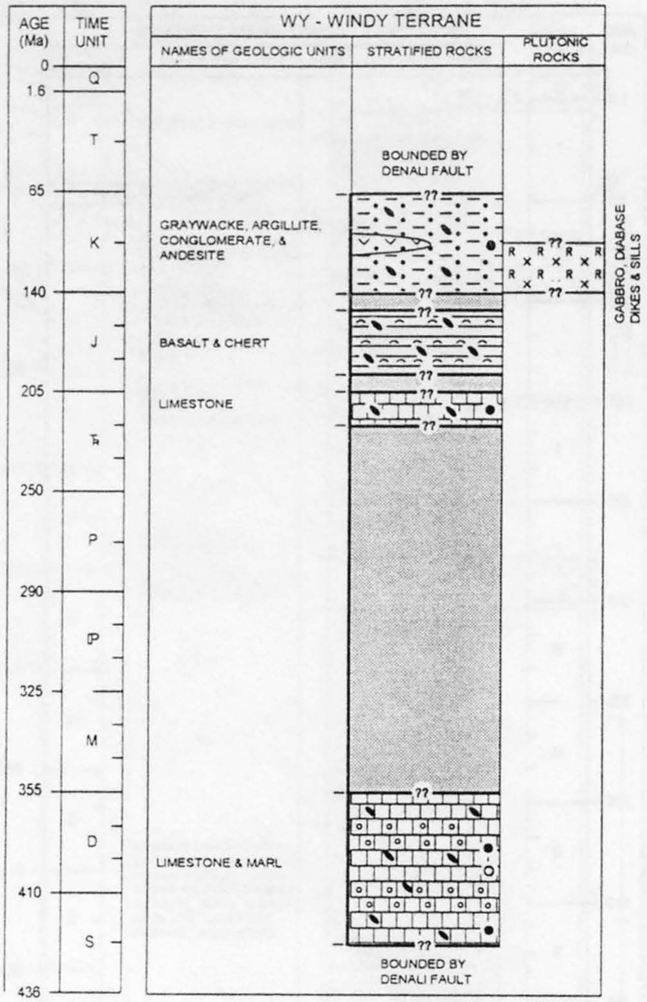


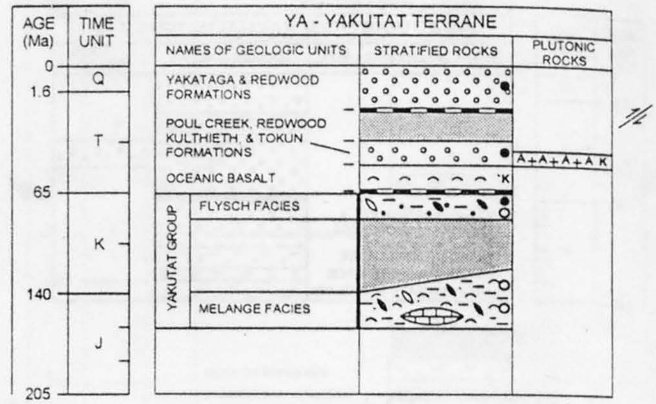

WRANGELLIA SUPERTERRANE, SOUTHERN ALASKA
WRW, WRANGELLIA SEQUENCE; WRA, ALEXANDER SEQUENCE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
WRANGELL LAVA
FREDERICKA FORMATION
MacCOLL RIDGE, CHITITU, MOONSHINE CREEK, SCHULZE, & KENNICOTT FMS.
GRAVINA-NUTZOTIN BELT, CHISANA, AND BERG CREEK FMS.
ROOT GLACIER FM., KOTSINA CONGLOMERATE, NIZINA MOUNTAIN FM.
LUBBE CREEK AND McCARTHY FMS
NIZINA & CHITISTONE LIMESTONES
NIKOLAI GREENSTONE
HASEN CREEK & EAGLE CREEK FMS
STATION CREEK & SLANA SPUR FMS & TETELNA VOLCANICS
KASKAWULSH GROUP: KASKAWULSH METAMORPHIC ROCKS: MARBLE, GREENSTONE, METAGRAYWACKE, PHYLLITE, SLATE, SCHIST, ARGILLITE, SILTSTONE, METAVOLCANIC ROCKS
BASE FAULTED
WRANGELL ARC
CHISANA, CHITINA, & GLACIER BAY-CHICHAGOF ARCS
SKOLAI ARC
WRANGELLIA SEQUENCE
ALEXANDER SEQUENCE

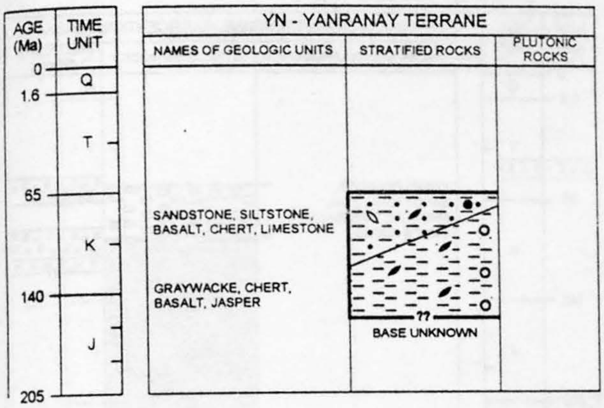

WRANGELLIA SUPERTERRANE, VANCOUVER ISLAND, CANADIAN CORDILLERA
WR - WRANGELLIA SEQUENCE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
NANAIMO GROUP
COAL HARBOUR FORMATION
KYUQUOT FORMATION
BONANZA FORMATION
PARSONS BAY FORMATION
QUATSINO FORMATION
KARMUTSEN FORMATION
BUTTLE LAKE GROUP
SICKER GROUP

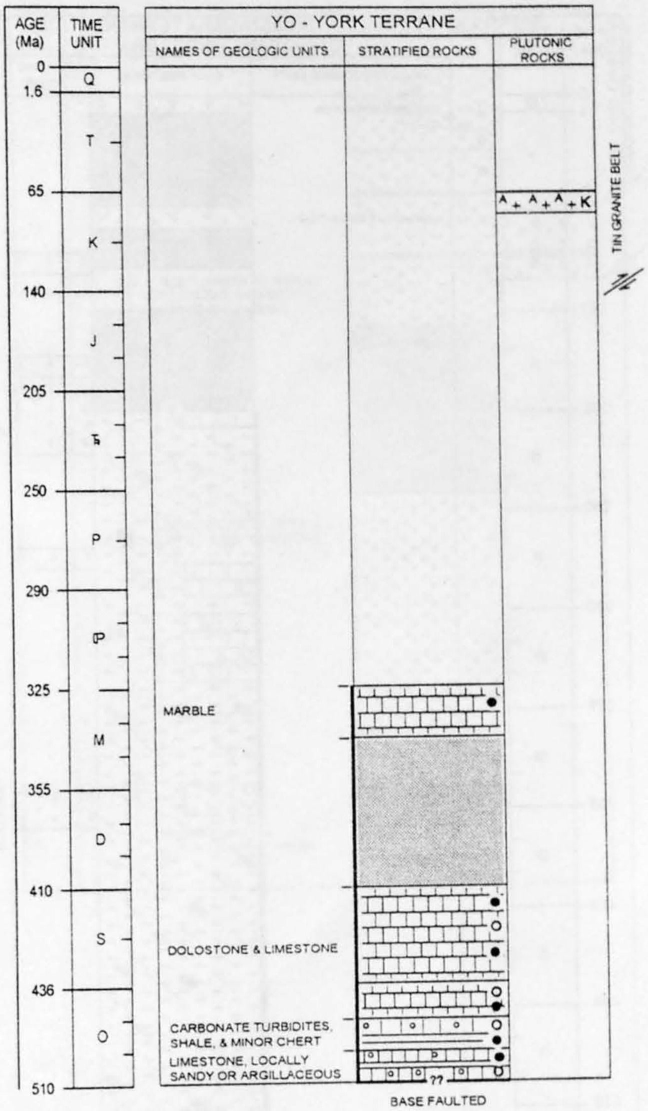

AGE (Ma)
TIME UNIT
WSA - WESTERN SAKHALIN TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
KRASNOYARKOVSKAYA, & ARKOVSKAYA SEQUENCES
TYMOVSKAYA SEQUENCE
POBEDINSKAYA SEQUENCE
SAMOKHINSKAYA SEQUENCE

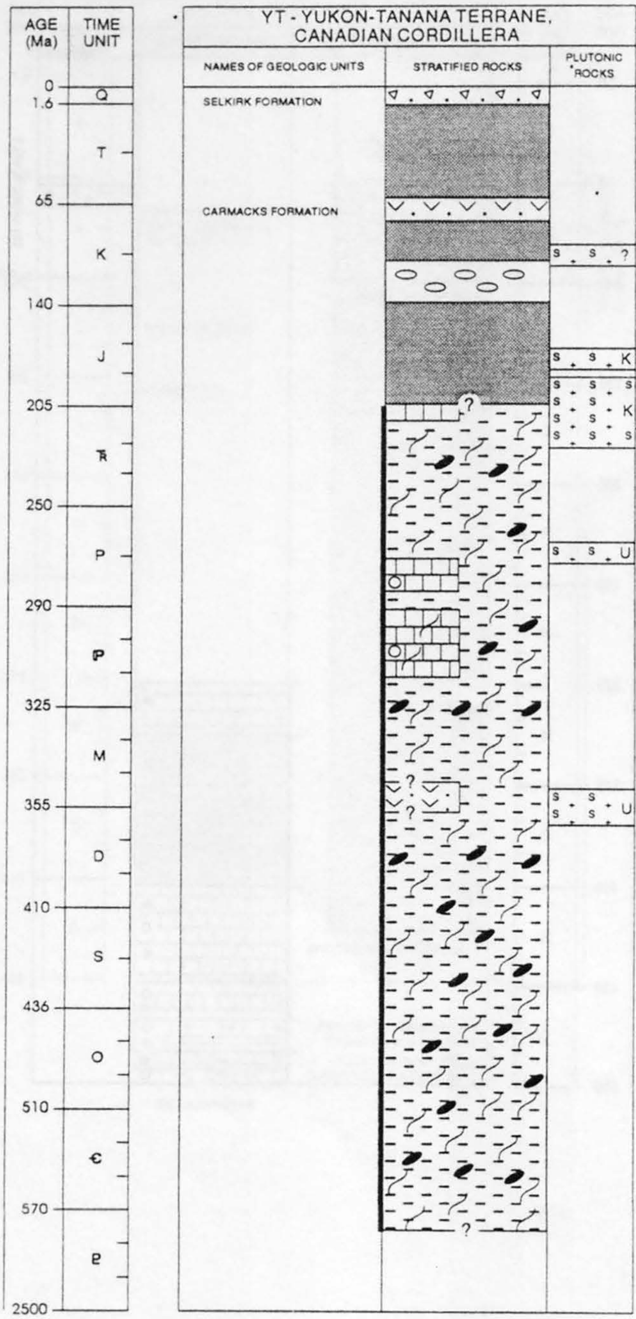

AGE (Ma)
TIME UNIT
WS - WICKERSHAM TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
250
P
290
325
M
355
D
410
S
436
O
510
570
2500
TOP FAULTED
QUARTZ SANDSTONE, & MAROON & GREEN ARGILLITE
BASE FAULTED

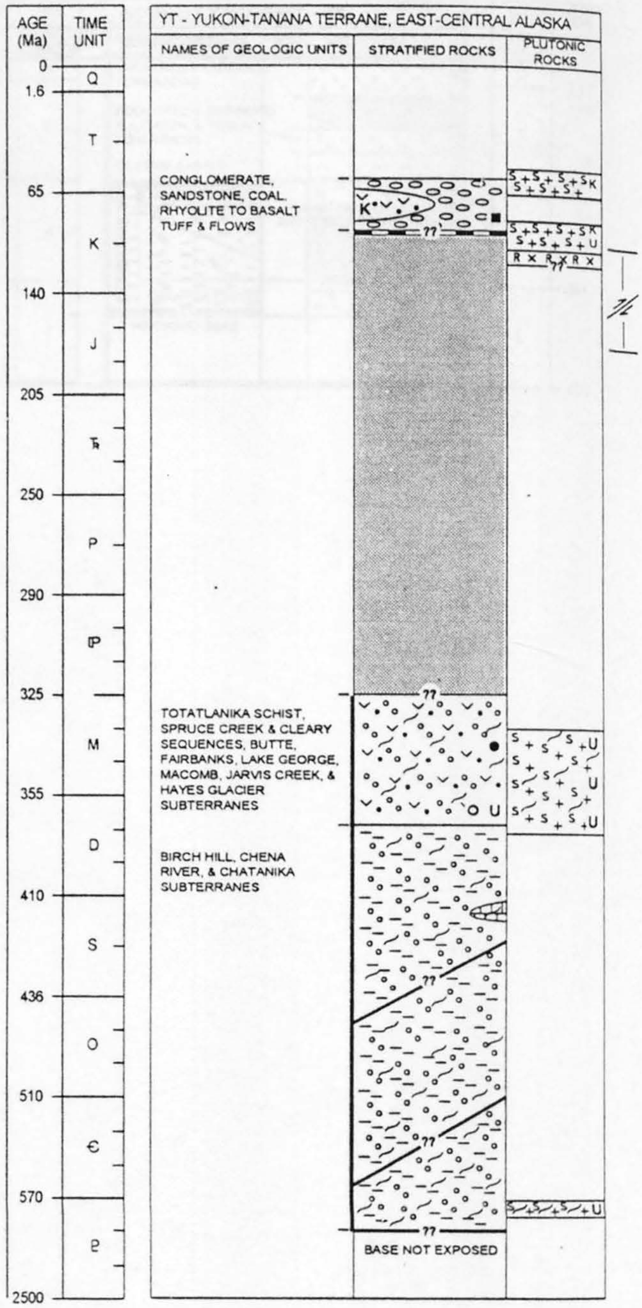

AGE (Ma)
TIME UNIT
WY - WINDY TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
Ћ
250
P
290
IP
325
M
355
D
410
S
436
BOUNDED BY DENALI FAULT
GRAYWACKE, ARGILLITE, CONGLOMERATE, & ANDESITE
BASALT & CHERT
LIMESTONE
LIMESTONE & MARL
GABBRO, DIABASE DIKES & SILLS
BOUNDED BY DENALI FAULT


AGE (Ma)
TIME UNIT
YA - YAKUTAT TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
Q
T
65
K
140
J
205
YAKATAGA & REDWOOD FORMATIONS
POUL CREEK, REDWOOD KULTHIETH, & TOKUN FORMATIONS
OCEANIC BASALT
YAKUTAT GROUP
FLYSCH FACIES
MELANGE FACIES

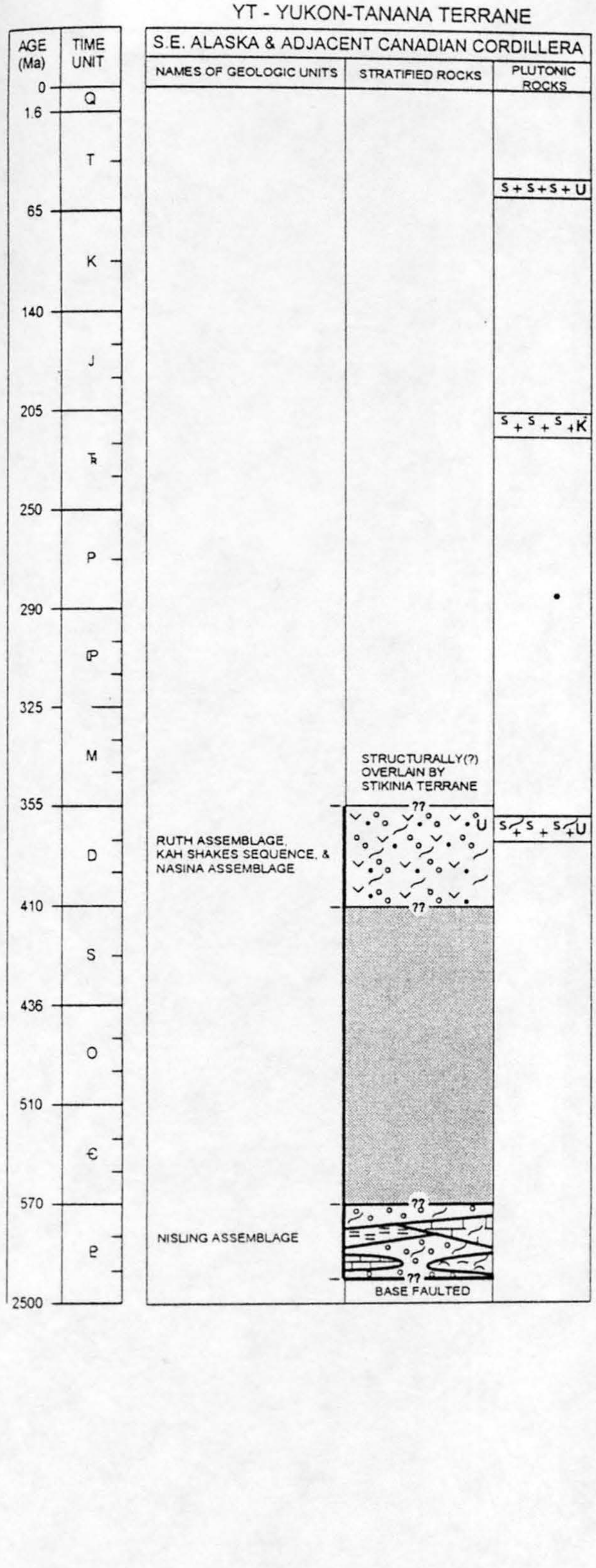

YN - YANRANAY TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
Q
T
K
J
SANDSTONE, SILTSTONE, BASALT, CHERT, LIMESTONE
GRAYWACKE, CHERT, BASALT, JASPER
??
BASE UNKNOWN


YO - YORK TERRANE
AGE (Ma)
TIME UNIT
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
Q
T
K
J
P
M
D
S
O
TIN GRANITE BELT
MARBLE
DOLOSTONE & LIMESTONE
CARBONATE TURBIDITES, SHALE, & MINOR CHERT
LIMESTONE, LOCALLY SANDY OR ARGILLACEOUS
??
BASE FAULTED

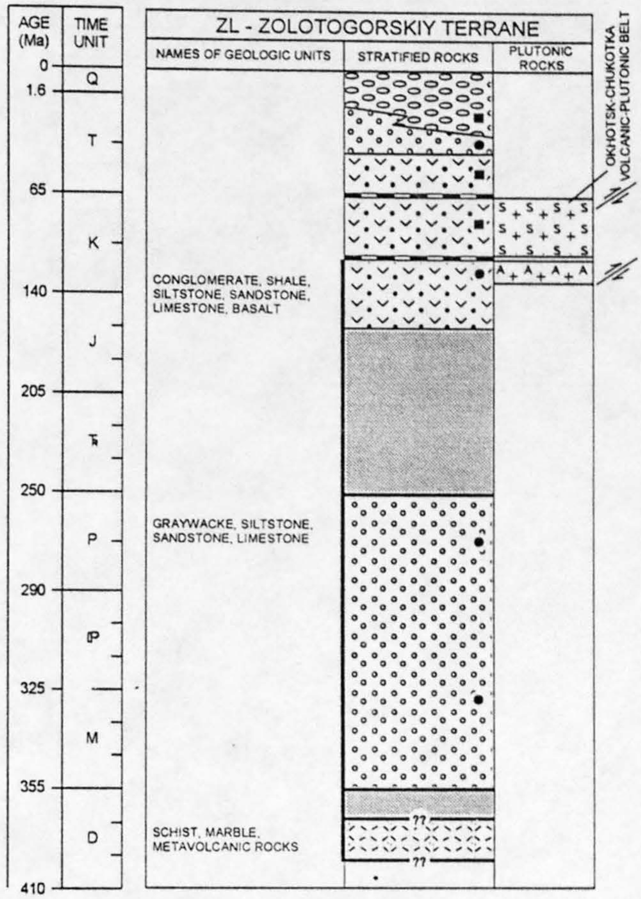

AGE (Ma)
TIME UNIT
YT - YUKON-TANANA TERRANE, CANADIAN CORDILLERA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
P
M
D
S
O
SELKIRK FORMATION
CARMACKS FORMATION
B
PELLY GNEISS

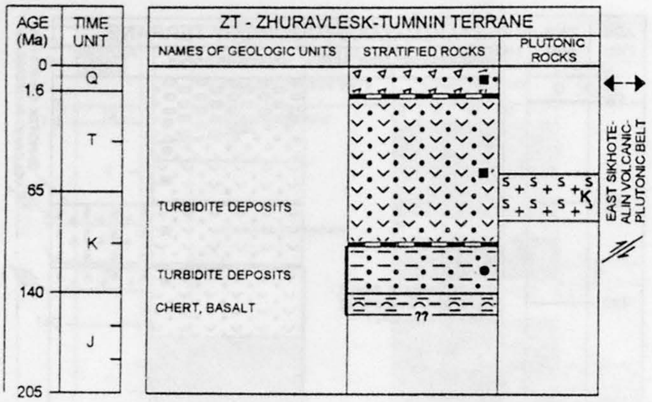

AGE (Ma)
TIME UNIT
YT - YUKON-TANANA TERRANE, EAST-CENTRAL ALASKA
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
250
290
325
355
410
436
510
570
2500
Q
T
K
J
P
M
D
S
O
CONGLOMERATE, SANDSTONE, COAL, RHYOLITE TO BASALT TUFF & FLOWS
TOTATLANIKA SCHIST, SPRUCE CREEK & CLEARY SEQUENCES, BUTTE, FAIRBANKS, LAKE GEORGE, MACOMB, JARVIS CREEK, & HAYES GLACIER SUBTERRANES
BIRCH HILL, CHENA RIVER, & CHATANIKA SUBTERRANES
BASE NOT EXPOSED

YT - YUKON-TANANA TERRANE



ZL - ZOLOTOGORSKIY TERRANE




AGE (Ma)
TIME UNIT
ZT - ZHURAVLESK-TUMNIN TERRANE
NAMES OF GEOLOGIC UNITS
STRATIFIED ROCKS
PLUTONIC ROCKS
0
1.6
65
140
205
Q
T
K
J
TURBIDITE DEPOSITS
TURBIDITE DEPOSITS
CHERT, BASALT
??
K
EAST SIKHOTE-ALIN VOLCANIC-PLUTONIC BELT