Tectonic and Metallogenic Model for Northeast Asia

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INTRODUCTION

This document describes the digital files in this report that contains a tectonic and metallogenic model for Northeast Asia. The report also contains background materials and is for sale on CD-ROM by USGS Information Services, Box 25286, Federal Center, Denver, CO 80225, telephone: 888 ASK-USGS; e-mail: infoservices@usgs.gov. This tectonic and metallogenic model and other materials on this report are derived from (1) an extensive USGS Professional Paper, 1765, on the metallogenesis and tectonics of Northeast Asia that is available on the Internet at http://pubs.usgs.gov/pp/1765/; and (2) the Russian Far East parts of an extensive USGS Professional Paper, 1697, on the metallogenesis and tectonics of the Russian Far East, Alaska, and the Canadian Cordillera that is available on the Internet at http://pubs.usgs.gov/pp/pp1697/.

The major purpose of the tectonic and metallogenic model is to provide, in "movie" format, a colorful summary of the complex geology, tectonics, and metallogenesis of the region. To accomplish this goal four steps were taken: (1) 13 time-stage diagrams, from the late Neoproterozoic (850 Ma) through the present (0 Ma), were adapted, generalized, and transformed into color static time-stage diagrams; (2) the 13 time-stage diagrams were placed in a computer morphing program to produce the model; (3) the model was examined and each diagram was successively adapted to preceding and subsequent diagrams to match the size and surface expression of major geologic units; and (4) the final version of the model was produced in successive iterations of steps 2 and 3.

The tectonic and metallogenic model and associated materials in this report are derived from a project on the major mineral deposits, metallogenesis, and tectonics of the Northeast Asia and from a preceding project on the metallogenesis and tectonics of the Russian Far East, Alaska, and the Canadian Cordillera. Both projects provide critical information on bedrock geology and geophysics, tectonics, major metalliferous mineral resources, metallogenic patterns, and crustal origin and evolution of mineralizing systems for this region. The major scientific goals and benefits of the projects are to: (1) provide a comprehensive international data base on the mineral resources of the region that is the first extensive knowledge available in English; (2) provide major new interpretations of the origin and crustal evolution of mineralizing systems and their host rocks, thereby enabling enhanced, broad-scale tectonic reconstructions and interpretations; and (3) promote trade and scientific and technical exchanges between North America and eastern Asia.

QUICK START

For those already familiar with motion-graphics applications and have one on their computer, go to http://pubs.usgs.gov/of/2011/1026/Model/Model.avi to start the tectonic and metallogenic model. Please note that for interactive starting and stopping of the model at various time stages, the file Model.avi can be copied to the computer hard drive. In addition, viewing of the model from a hard drive will permit manual reversing and advancing of the model.

After the introductory title, explanation, and suggestions for viewing, the model starts for each of 13 time stages from the Neoproterozoic (850 Ma) through the present (0 Ma). Each time stage is depicted sequentially with: (1) a view of the main geologic and tectonic units for the time stage; (2) a view of the units with superposed labels and major sedimentary basins; and (3) a view of the main units and major metallogenic belts. For any view, the player can be stopped to permit detailed study.
The following are suggestions for viewing the model, as summarized in the second slide, are: (1) view the model a time or two without halting in order to gain an overview; and (2) view the model with periodic halts while reading the below summary of the major features for each time stage of the model.

If more information is desired, read: (1) chapter 1 (Introduction) of Professional Paper 1765 that provides a summary of the regional geology, tectonics, and metallogenesis of Northeast Asia; and (2) Chapter 9 (Tectonic and Metallogenic Model for Northeast Asia) that provides a detailed explanation of the tectonic and metallogenic model. For additional information, parts or all of the Professional Paper 1765 can be read. In addition, for information on the entire Russian Far East, the appropriate parts of Professional Paper 1697 on the Metallogenesis and Tectonics of the Russian Far East, Alaska, and the Canadian Cordillera can be read. For both papers, Adobe PDF files are provided.

Please note that the model is centered on the North Asian Craton (that is, the northern tip of Lake Baikal). As a result, lines of paleolatitude migrate across the model through geologic time. And because of space limitations (the viewing area of the model must be confined to one monitor display), other major cratons, such as the Sino-Korean Craton, do not appear in the model until near the time of accretion to the North Asian Craton.

SUMMARY OF MAJOR FEATURES FOR EACH TIME STAGE OF MODEL

Time Stage 1 – Neoproterozoic (Riphean) (850 Ma)

The major features are:

(1) Passive continental margins formed on the submerged margins of the North-Asian craton, including the East Angara (EA), Baikal-Patom (BP), and Verkhoyansk (VK) cratonal margins. In addition, passive continental margins formed on the Argun-Idermeg superterrane.

(2) Widespread intracontinental rifting was initiated along parts of these passive continental margins.

(3) Platform cover accumulated onto the inner parts of the North Asian craton.

(4) Several major island-arc systems and tectonically linked subduction zones formed offshore or adjacent to the North Asian craton, including the Near-Yenisey, Baikal-Muya, and Zavhan magmatic arcs.

(5) Formation of major metallogenic belts related to sedimentary basins formed on cratonal margins, rift basins; island arcs, and terrane accretion.

Time Stage 2 – Early Cambrian (Vendian) (545 Ma)

The major features are:

(1) Completion of Neoproterozoic accretion of several island-arc systems and tectonically linked subduction zones onto the North Asian craton, including the Near-Yenisey, Baikal-Muya, and Zavhan magmatic arcs.

(2) Formation of new island-arc systems, including the Salair, Kuznetsk-Tannuola and Dzhida-Lake arcs, and tectonically linked subduction zones.

(3) Subduction of the Paleo-Asian ocean plate to form various oceanic and subduction-zone terranes associated with the island arcs. Behind the island arcs were the Minusa-Tuva and the Transbaikal marginal seas that are interpreted as the fragments of an oceanic plate separated by island arcs.

(4) Formation of major metallogenic belts related to transpressive continental-margin arcs and island arcs.

Time Stage 3 – Late Cambrian (510 Ma)

The major features are:

(1) Completion of accretion of the late Neoproterozoic and Early Cambrian island-arc systems described above.

(2) Continued formation of a passive continental margin along the northern and northeastern periphery of the North Asian craton.

(3) Formation of the Salair island arc (part of the Altai collage) and South Mongolia-Khingan island arc (part of the South Mongolia-Khngan collage) and associated subduction zones near the margins of the North Asian craton.

(4) Formation of turbidite basins along the southern transform margin of the North Asian craton in the area of accreted terranes.

(5) Deformation of the accreted island arcs and back-arc basins that started at the end of the Middle Cambrian and continued through the Silurian in a transpressional and dextral-slip faulting environment.

(6) Accumulation of flysch along the North Asian (Verkhoyansk) cratonal margin.

(7) Formation of turbidite units along the southern margin of the North Asian craton.

(8) Formation of major metallogenic belts related to transpressive continental-margin arcs and to volcanic or sedimentary belts on the North Asian craton or in accreted terranes.

Time Stage 4 – Early Ordovician (475 Ma)

The major features are:

(1) Continued formation of a passive continental margin along the northern and northeastern periphery of the North-Asian craton.

(2) Continued accumulation of flysch along the southern North Asian craton transform continental margin.

(3) Continued deformation of accreted island arcs and back-arc basins in a transpressional and dextral-slip faulting environment.

(4) Formation of the Tannuola plutonic belt as a transpressive continental-margin arc.

(5) Continued formation of the Salair island arc (part of the Altai collage) and South Mongolia-Khingan island arc (part of the South Mongolia-Khngan collage) and associated subduction zones along the margins of the North Asian craton.

(7) Formation of the Amandykan continental margin and back-arc rifts along the northeastern margin of the North Asian craton (in present-day coordinates).

(8) Inception of dextral-slip and rifting migration of the Argun-Idermeg superterrane along the southern margin of the North Asian craton and previously accreted terranes.

(9) Formation of a major metallogenic belt related mainly to the Tannuola plutonic belt, a transpressive continental-margin arc, and related sutures.

Time Stage 5 – Late Silurian (410 Ma)

The major features are:

(1) Continued formation of a passive continental margin along the northern and northeastern periphery of the North-Asian craton.

(2) Continued accumulation of flysch along the southern North Asian craton transform continental margin.

(3) Continued deformation of accreted island arcs and back-arc basins in a transpressional and dextral-slip faulting environment.

(4) Accretion of the Salair island arc (part of the Altai collage)

(5) Formation of the South Siberian transpressive continental-margin arc during oblique convergence between the Mongolial-Okhotsk ocean plate and the North Asian craton.

(7) Continued formation of the South Mongolia-Khingan island arc and associated subduction zones (parts of the South Mongolia-Khingan collage).

(8) Inception of the Rudny Altay islanc arc and associated subduction zones (parts of the West Siberian collage).

(9) Opening of the Mongolia-Okhotsk ocean with migration of the South Mongolia-Khingan and Rudny Altay island arcs and the Argun-Idermeg superterrane away from the southern margin of the North Asian craton.

(10) Along the northeastern margin of the North Asian craton, continuation of the Amandykan continental margin along with back-arc rifts.

(11) The major metallogenic belt is related mainly to the South-Siberian transpressive continental-margin arc.

Time Stage 6 – Late Devonian (370 Ma)

The major features are:

(1) Continued formation of the South Mongolia-Khingan and the Rudny Altay island arcs and associated subduction zones.

(2) Continued opening of the Mongolia-Okhotsk ocean with migration of the South Mongolia-Khingan and Rudny Altay island arcs and the Argun-Idermeg superterrane away from the southern margin of the North Asian craton.

(3) Beginning of assembly of cratonal and passive continental-margin terranes (now in the Russian Far East and Northeast China) to form the Bureya-Jiamusi superterrane.

(4) Along the northeastern margin of the North Asian craton, inception of the Kedon continental-margin arc and associated subduction zones.

(5) Oblique convergence between the Mongol-Okhotsk ocean plate and the North Asian craton, resulting in transform displacement and oroclinal wrapping of the southern and western margins of the North Asian craton and continued formation of the South Siberian transpressional arc.

(6) Tectonically linked and coeval formation of the Hangay-Dauria subduction zone.

(7) Rifting of the northeastern margin of the North Asian craton and craton margin to form various terranes in the Oimyakon Ocean, and associated rift-basin sedimentation along the northeast margin of the North Asian craton.

(8) Formation of major metallogenic belts related to the Rudny Altay and South Mongolia-Khingan island arcs, the South-Siberian transpressive continental-margin arc, intrusion of kimberlite pipes, rifting, and the Kedon continental-margin arc.

Time Stage 7 – Late Permian (250 Ma)

The major features are:

(1) In the northern North Asian craton, formation of the Tungus Plateau igneous province with widespread intrusive traps consisting of extensive belts of sills and dikes that intruded along major fault zones and extrusion of widespread basalt.

(2) Migration of previously rifted fragments (now terranes) away from the northeastern margin of the North Asian craton to become widely spaced parts of the Kolyma-Omolon superterrane.

(3) Inception of the Alazeya island arc near fragments of the Kolyma-Omolon supterterrane.

(4) Inception of closure of the Mongolia-Okhotsk Ocean and inception of accretion of the Agun-Idermeg superterrane.

(5) Formation of the East Mongolian arc along the margin of the Argun-Idermeg superterrane and formation of the tectonically linked Tukuringra-Dzhadgy and Dzhagdy subduction zones.

(6) Formation of the Gobi-Khankaisk-Daxing'anling continental-margin arc along the outboard edge of the accreted South Mongolia-Khingan collage and the Argun-Idermeg superterrane.

(7) Formation of the transform-continental-margin Selenga and Hangay arcs along the southern margin of the North Asian craton and accreted terranes.

(8) Beginning of closure of the Mongol-Okhotsk Ocean and inception of an extensive, mainly right-lateral series of transform faults.

(9) Accretion of the Bureya-Jiamusi superterrane to the outboard margin of the Argun-Idermeg superterrane.

(10) Formation of the Jihei continental-margin arc along the margin of the Bureya-Jiamusi superterrane.

(11) Formation of the North Margin continental-margin arc along the edge of the appearing Sino-Korean craton.

(12) Formation of the Kara collisional granite belt from prior collision of the Kara terrane along the northern margin of the North Asian craton.

(13) Formation of major metallogenic belts related to superplume intrusion and trap magmatism, continental-margin arcs, island arcs, and terrane collision.

Time Stage 8 – Late Triassic (210 Ma)

The major features are:

(1) Accretions of the Argun-Idermeg superterrane, the Bureya-Jiamusi supterterrane, and the Sino-Korean craton.

(2) Continuation of closure of the Mongol-Okhotsk Ocean and continuation of an extensive, mainly right-lateral series of transpressional faults along the closed part of the ocean.

(3) Formation of the Selenga and Mongol-Transbaikal transpressional arcs along the transpressional fault system.

(4) Inception of the Uda-Murgal continental-margin and island-arc system along the eastern margin of the North Asian craton associated with subduction of the Ancestral Pacific Ocean Plate.

(5) Continuation of the Alazeya island arc near fragments of the Kolyma-Omolon supterrrane.

(6) Formation of major metallogenic belts related to transpressional arcs and to subducted oceanic crust.

Time Stage 9 – Late Jurassic (145 Ma)

The major features are:

(1) Final closure of the Mongolia-Okhotsk Ocean with resultant displacement of collisional processes eastward.

(2) Continued formation of transpressional fault zones along the axis of the closed Mongol-Okhotsk Ocean.

(3) Continued formation of the Selenga, Mongol-Transbaikal, Trans-Baikalian Daxinganling, and Umelkan-Ogodzha arcs along the axis of the closed Mongol-Okhotsk Ocean in a transpressional-fault setting.

(4) Postcollisional transform faulting along within-plate transpression zones in Northeast China.

(5) Formation of the collisional Uda-Stanovoy arc along the southern margin of the Aldan-Stanovoy shield of the North Asian craton and westward into the eastern Transbaikalia region.

(6) Formaton of the Uyandina-Yasachnaya volcanic belt on the coalesced fragments of the Kolyma-Omolon superterrane before accretion.

(7) Accretion of the Kolyma superterrane and Okhotsk cratonal terrane against the Verkhoyansk (North Asian) cratonal margin and formation of collision-related granitoids, such as the Main Granite Belt, and associated volcanic units.

(8) Formation of the Oloy continental-margin arc along the outboard edge of the accreted Kolyma-Omolon superterrane.

(9) Continued formation of the Uda-Murgal continental-margin arc and tectonically linked subduction zones in response to subduction of the Ancestral Pacific Ocean Plate.

(10) Approaching and accretion (in the Early to mid-Cretaceous) of the Chukotka terrane and marginal Nutesyn arc to the northern margin of the previously accreted Kolyma-Omolon superterrane.

(11) Beginning of underthrusting of the Kula oceanic ridge with bimodal igneous rocks along the transform continental margin in the Russian Far East.

(12) Formation of the Jihei volcanic and plutonic belt during interplate extensional tectonism.

(13) Formation of the the Daebo Granite belt in response to subduction of the Ancestral Pacific Ocean Plate.

(14) Formation of major sedimentary basins on cratons and accreted terranes.

(15) Formation of major metallogenic belts related to transpressional arcs, underthrusting of the Kula Oceanic Ridge, and collision and accretion.

Time Stage 10 – Late Cretaceous (85 Ma)

The major features are:

(1) After accretion of the Kolyma-Omolon superterrane and Mainitskiy island arc, outboard of the terranes accreted along the eastern margin of the North Asian craton, outboard stepping of subduction and formation of the major Late Cretaceous and early Tertiary Okhotsk-Chukotka continental-margin arc.

(2) After accretion of the Bureya-Jiamusi supterterrane and the Sino-Korean craton in the Late Jurassic through Early Cretaceous, and accretion of outboard terranes, outboard stepping of subduction and formation of the East Sikote-Alin continental-margin arc (containing the East Sikote-Alin volcanic-plutonic belt).

(3) Continued subduction of the Ancestral Pacific Ocean Plate to form tectonically linked subduction zones outboard of the Okhotsk-Chukotka and East Sikhote-Alin arcs.

(4) Formation of granitoids along the the Khingan transform continental-margin arc in response to oblique subduction of the Ancestral Pacific Ocean Plate.

(5) Formation of major back-arc basins in the Russian Northeast behind the Okhotsk-Chukotka continental-margin arc and in northern China behind the East Sikhote-Alin continental-margin arc.

(6) Late-stage continuation of transpressional-fault zones along the axis of the closed Mongol-Okhotsk Ocean, and postcollisional transform faulting along within-plate transpression zones in Northeast China.

(7) In the late part of this time span, in the area of the East Sikhote-Alin fault, formation of a major continental-margin transform-fault system in the Russian Southeast along with generation of bimodal granitic and volcanic rocks.

(8) In the area to become Japan, accretion of the Honshu-Sikhote-Alin collage that is composed mainly of island-arc, continental-margin turbidite (flysch), and subduction-zone terranes.

(9) To the north of the North Asian craton, inception of rifting and initial formation of the Eurasia Basin and Arctic Ocean.

(10) Formation of major metallogenic belts related to opening of the Eurasia Basin and to continental-margin arcs.

Time Stage 11 – Eocene (50 Ma)

The major features are:

(1) Approach and accretion of the Olyutorka-Kamchatka island arc and subduction zone onto the northeast margin of Northeast Asia.

(2) With accretion of outboard terranes, cessation of the Okhotsk-Chukotka continental-margin arc.

(3) Approach and accretion of the Terprniya-Nemuro island arc and subduction zone onto the eastern margin of Northeast Asia.

(4) Continuation of transpressional-fault zones along the axis of the closed Mongol-Okhotsk Ocean and

postcollisional, transform faulting along within-plate transpression zones in Northeast China.

(5) Continued formation of the major continental-margin transform-fault system and generation of the younger part of the East Sikhote-Alin transform continental-margin arc in the Russian Southeast and Northeast China.

(6) Formation of extensive graben basins inboard of continental-margin arcs.

(7) Continued rifting with formation of the Gakkel oceanic ridge, Eurasian Basin, and Arctic Ocean.

(8) Formation of major metallogenic belts related to opening of the East Sikhote-Alin transform continental-margin arc.

Time Stage 12 – Miocene (10 Ma)

The major features are:

(1) Formation of the short-lived Central Kamchatka continental-margin arc along the outboard margin of northern Northeast Asia.

(2) Migration and accretion of the Kronotskaya island arc and subduction zone onto the northeast margin of Northeast Asia.

(3) After accretion, outboard stepping of subduction and inception of the Kamchatka-Kuril arcs.

(4) Formation of the Japan continental-margin arc in response to subduction of the Pacific Ocean Plate.

(5) Occurrence of back-arc spreading between the Japan arc and the southern part of Northeast Asia.

(6) Continued formation of extensive graben basins inboard of continental-margin arcs.

(7) To the south, formation of the Izu Bonin continental-margin arc.

(8) In the Oligocene to Miocene, formation of the Baikal rift and the Central Asia basalt field.

(9) Continued rifting with formation of the Gakkel oceanic ridge, Eurasian Basin, and Arctic Ocean.

(10) Formation of major metallogenic belts related to continental-margin arcs and back-arcs and to an impact crater.

Time Stage 13 – Present (0 Ma)

The major features are:

(1) Continued formation of the Kuril-Kamchatka continental-margin arc along the eastern margin of Northeast Asia.

(2) Continued formation of the Japan continental-margin arc and back-arc spreading between the arc and the southern part of Northeast Asia.

(3) To the south, continued formation of the Izu Bonin continental-margin arc.

(4) Continued rifting and formation of the Gakkel oceanic ridge, the Eurasian Basin, and the Arctic Ocean.

(5) Continued formation of the Baikal rift.

(6) On the basis of modern-day earthquake foci, formation of several new tectonic plates across the region.

(10) Formation of major metallogenic belts related to continental-margin arcs and back arcs.

VIEWING AND READING PROGRAMS

The tectonic and metallogenic model is in Windows Media Player format (*.avi). Explanatory materials, including explanations, tables, and a companion article are in Adobe PDF files (*.pdf). Plain text files are in ASCII (*.txt).

Reading and viewing programs can be obtained as follows. The latest version of Windows Media Player can be obtained from the Web at: http://windows.microsoft.com/en-US/windows/products/windows-media. The latest version of Adobe reader can be obtained from the Web at: http://get.adobe.com/reader/. The latest version of Quicktime can be obtained from the Web at: http://www.apple.com/quicktime/download/.

CONTENTS AND LINKS

Documentation for this publication is in this file (of2011-1026.pdf).

The directories for this report, including the tectonic and metallogenic model, are stored in the following directories under the indicated file name. In alphabetical order, the files are described as follows

Directory \Model

The directory \Model contains the tectonic and metallogenic model in Windows Media Player format (*.avi).

With the Windows Media Player program, or the QuickTime Movie Player program, the Windows Media Player file (Model.avi) can be viewed on both Windows and Macintosh computers. For easier manipulation of the computer model, the files can be copied onto a hard drive. Viewing from a hard drive will permit manual reversing and advancing of the model.

In Windows Media Player, the button with the two vertical bars, near the lower-center part of the window, can be used to stop the animation. To start the animation, click on the button with a large right-pointing arrow. Stopping the animation at each of the major times will serve to show the major igneous-related metallogenic belts and lettering. If desired, the tectonic and metallogenic computer model can be set to run forever, that is, repeat.

Directory \Model_Figures

The directory \Model_Figures contains digital files for the simplified time-stage figures that are adapted from the USGS Professional Paper 1765 on the metallogenesis and tectonics of Northeast Asia. The figures are provided in Adobe PDF (*.pdf) and Corel Draw X4 (*.cdr) formats. In addition, the PDF figures can be imported into newer versions of Adobe Illustrator. In both PDF and Corel Draw formats, each figure has layers that can be displayed or hidden.

USGS Professional Paper 1765

The USGS Professional Paper 1765 contains Adobe PDF and other digital files for text and figures on the Metallogenesis and Tectonics of Northeast Asia. This paper provides essential data and interpretations for the tectonic interpretations for the tectonic and metallogenic model. The book is provided in Adobe PDF format and consists of nine chapters and three appendices as follows: (1) an introductory chapter; (2) a chapter on methodology of regional metallogenic and tectonic analysis; (3) a chapter on mineral deposit models for the region; (4) five chapters that describe the regional metallogenesis and tectonics of the region from the Archean through the Present for successive time stages; (5) a chapter on a metallogenic and tectonic model for the region; and (6) three appendixes, including on a description of the project and products, a description of map units for the Northeast Asia geodynamics map, and a summary table of metallogenic belts for the region. Each chapter and appendix is a separate directory.

With the Adobe Reader, the files can be viewed and printed. The complete book is also contained in a single large Adobe PDF file named pp1765.pdf. The book is available at http://pubs.usgs.gov/pp/1765/

USGS Professional Paper 1697

USGS Professional Paper 1697 contains an Adobe PDF file for the text and figures on the metallogenesis and tectonics of the Russian Far East, Alaska, and the Canadian Cordillera. This paper provides essential data and interpretations for the Russian Far East part of the Northeast Asia tectonic and metallogenic model. The book is provided in Adobe format and consists of a single PDF file available at http://pubs.usgs.gov/pp/pp1697/.

PRODUCTION OF TECTONIC AND METALLOGENIC MODEL

The tectonic and metallogenic model was produced using the high-end computer morphing program, *FantaMorph* from Abrosoft. The morphing was done with 13 static, time-stage diagrams prepared in Corel Draw and exported into JPG format. Use of the *FantaMorph* program produced about 2,130 intermediate diagrams, to produce the sequence of time-stage figures with explanatory data. The tectonic and metallogenic model was prepared in the fall of 2010.

ASSOCIATED PROJECT

The area of the associated project on the metallogenesis and tectonics of Northeast Asia, that produced various publications from which this publication is derived, encompasses the area of eastern Russia (most of eastern Siberia and the Russian Far East), Mongolia, northern China, South Korea, Japan, and adjacent offshore areas. The major purpose of the project is to provide a comprehensive synthesis of the regional geology, tectonics, and metallogenesis of Northeast Asia for readers who are unfamiliar with the region and for researchers who desire detailed information on the region. An important goal of the project is to demonstrate how a high-quality metallogenic and tectonic analysis, including construction of an associated metallogenic-tectonic model, greatly benefits other mineral resource studies by (1) synthesizing of mineral-deposit models, (2) improving prediction of undiscovered mineral deposits as part of quantitative mineral-resource-assessment studies, (3) assisting land-use and mineral-exploration planning, (4) improving knowledge of regional geology, (5) improving interpretations of the origins of host rocks,

mineral deposits, and metallogenic belts, and (6) suggesting new research.

Research on the metallogenesis and tectonics of such major regions as Northeast Asia requires a complex methodology, including (1) definitions of key terms, (2) compilation of a regional geologic base map that can be interpreted according to modern tectonic concepts and definitions, (3) compilation of a mineral-deposit database that enables a determination of mineral-deposit models and clarification of the relations of deposits to host rocks and tectonic origins, (4) synthesis of a series of mineral-deposit models that characterize the known mineral deposits and inferred undiscovered deposits in the region, (5) compilation of a series of metallogenic-belt belts constructed on the regional geologic base map, and (6) construction of a unified metallogenic and tectonic model. The major products of this project are described in appendix A in Professional Paper 1765.

The Northeast Asia project builds on and extends the data and interpretations from a previous project on the *Major Mineral Deposits, Metallogenesis, and Tectonics of the Russian Far East, Alaska, and the Canadian Cordillera* conducted by the USGS, the Russian Academy of Sciences, the Alaska Division of Geological and Geophysical Surveys, and the Geological Survey of Canada. The publications of this project are also described in appendix A in Professional Paper 1765.

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