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Peculiarities in creation of transnational GIS (using GIS "Mineral Resources, Metallogenesis and Tectonics of Northeast Asia" as an example)

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A concept of the transnational geological GIS creation consists in the consideration of spatial objects under study as an integrated complex system with its specific internal structure and cause-and-effect relations between its separate units. GIS application is a tool of systems approach, means of reality imaging when the real object (or a group of objects) is studied via specially developed model which reproduces attributes and characteristics of the original and a process. In this case, GIS data are founded on a common geological concept; geological objects are described by the interrelated features on the basis of common geological classifications; digital maps have a same topographic (geographical) background and legends concordant between each other and etc. GIS-technology for the creation of transnational geological GIS is based on the suggested concept and consists of following successive stages: design of a system (formalization of geological objects and their interrelations is the controlling factor in this stage); selection of hard- and software for realization of GIS-technology; creation of a topographic background (map); formation of digital maps and attribute databases in a GIS-environment; organization of a maximal interrelation between digital maps and databases for solving the information retrieval problems; development of a user-friendly interface. The suggested concept and GIS-technology has been successfully applied for the creation of GIS "Mineral Resources, Metallogenesis and Tectonics of North-East Asia". The system stores, processes, displays, disperse, and accesses cartographic and attribute information about geological objects of Eastern and Southern Siberia, South of the Russian Far East, Mongolia, North-East China, Korea, and Japan. *KEYWORDS: transnational GIS; GIS-technology; mineral resources; metallogenesis; tectonics.*

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1 Introduction

A concept of the transnational geological GIS creation consists in the consideration of spatial objects under study as an integrated complex system with its specific internal structure and cause-and-effect relations between its separate units. GIS application is a tool of systems approach, means of reality imaging when the real object (or a group of objects) is studied via specially developed model which reproduces attributes and characteristics of the original and a process. In this case, GIS data are founded on a com-

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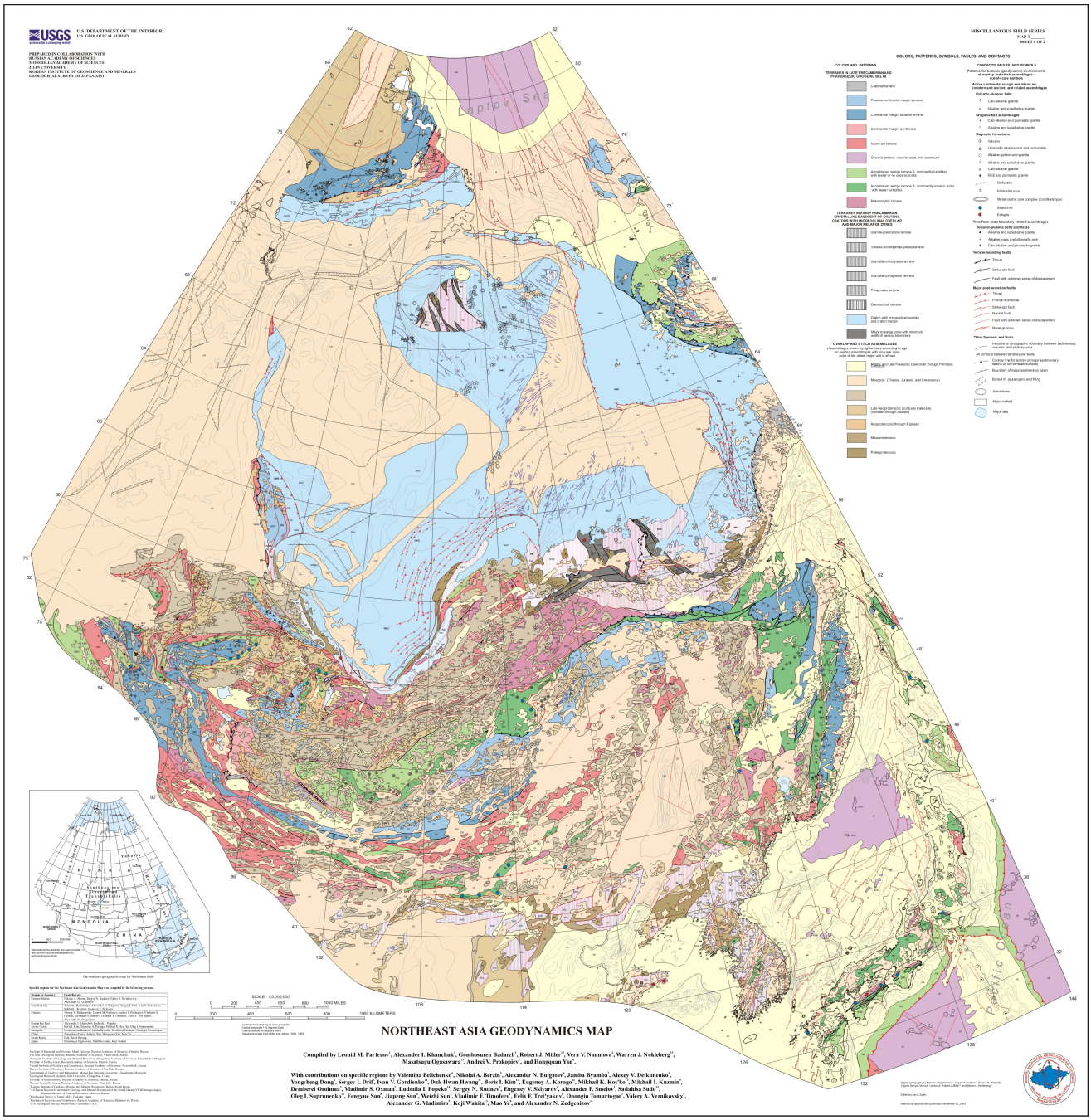

Figure 1. Northeast Asia geodynamics map.

mon geological concept; geological objects are described by the interrelated features on the basis of common geological classifications; digital maps have a same topographic (geographical) background and legends concordant between each other and ets [*Naumova*, 2008].

2 Discussion

GIS-technology for the creation of transnational geological GIS is based on the suggested concept and consists of following successive stages: design of a system (formaliza-

tion of geological objects and their interrelations is the controlling factor in this stage); selection of hard- and software for realization of GIS-technology; creation of a topographic background (map); formation of digital maps and attribute databases in a GIS-environment; organization of a maximal interrelation between digital maps and databases for solving the information retrieval problems; development of a user-friendly interface.

The suggested concept and GIS-technology has been successfully applied for the creation of GIS "Mineral Resources, Metallogenesis and Tectonics of Northeast Asia". The system stores, processes, displays, disperse, and accesses cartographic and attribute information about geological objects of Northeast Asia.

The described GIS is a part of the six-year international project "Mineral Resources, Metallogenesis, and Tectonics of Northeast Asia", being realized under the leadership of the US Geological Survey by a number of research institutions of Russia, Mongolia, China, South Korea, and Japan [*Naumova et al.*, 2006a].

Territory of the project – East and South Siberia, South of the Russian Far East, Mongolia, Northeast China, South Korea, Japan, and the adjacent sea. The mapped area rests within 30–82°N and 75–144°E coordinates.

Principal GIS Topics

- "Geography"
- "Geodynamics"
- "Mineral deposits"
- "Metallogenic belts"

Geography includes geographic positions and names of major cities and rivers, railways, state orders, and shorelines.

Geodynamics includes (see Figure 1):

1. Tectonic-stratigraphic terranes: Late Precambrian and Fanerozoic orogenic belt terranes, Early Precambrian crystalline cratonal terranes. Information about a terrane defines its geographic position and short description, abbreviated and full name, type, text description, references, and a tectonic-stratigraphic column picture.

2. Overlap assemblages corresponding to active continental margins and island arcs: volcanic-plutonic belts, back-arc basin formation, passive continental continental margin formations, intracontinental complexes, magmatic formations, transform-plate boundary-related assemblages. Information about an overlap assemblage defines its geographic position, short text description, references, abbreviated and full names, age, rock type, overlap assemblage type.

3. Faults: terrane bordering faults, major post-accretionary faults. The information about faults defines their geographic position and some descriptions, which are abbreviated and full names, type.

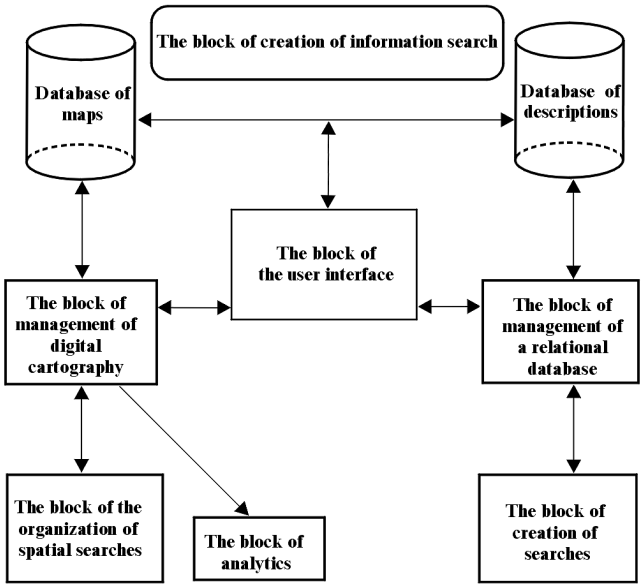

Figure 2. Principle functions of GIS.

Mineral deposits include the dots corresponding to deposit locations and such characteristics as name, geographic position, age, deposit model, basic metals.

Metallogenic belts – location of metallogenic belts, hosting rock and associated mineral deposits inclusive:

1. Twelve time-periods corresponding major geodynamic events and ore-forming processes were used to determine metallogenic belts. Time-periods are distinguished in accordance to the most important mineralization and associated tectonic events.

2. Time-periods distinguished: Archaean, Proterozoic 1, Proterozoic 2, Proterozoic 3, Late Proterozoic through Silurian, Devonian through Early Carboniferous, Late Carboniferous through Middle Triassic, Late Triassic through Early Cretaceous, Cenomanian through Campanian, Maastrichtian through Oligocene, Miocene through Quaternary.

3. Information about metallogenic belts includes their geographic position and some characteristics as age, type, etc.

The GIS compilation utilizes ESRI technology, both Arc/Info 8.0, and Arc View 3.2, is compiled at a scale of 1 : 5 million, uses an Lambert Equal-Area Azmuthal projection, and contains database descriptions from a Microsoft Access compilation. Construction GIS allows to carry out information search and in Microsoft Access, and in Arc View in a mode a client–server accordingly.

Principle functions of GIS (Figure 2):

1. Storage of information in the developed data model.

2. Management of descriptive and spatial data.

3. Direct access to descriptive data in GIS-environment.

4. Multipurpose search of cartographic objects, and data base objects, as well as on transit from one to another type of objects.

5. Multi-criterion search of any particular type or several types of your own information by means of Microsoft Access and Arc View search functions, as well as search of information using the client-server mode of these two programs.

6. Functions which are able to add and edit information, new cartographic and table materials inclusive.

7. Functions which are able to get any combination of cartographic materials.

8. Functions which are able to create new thematic maps on the basis of the information stored in GIS.

9. Functions which are able to prepare standard reports, tables, diagrams, graphs.

10. Printing of information, cartographic inclusive.

Supplements to GIS include:

- Interpretation of correlating data on geodynamics, mineral resources, metallogenics, and geophysics will create the new information on Northeast Asian tectonic and metallogenic characteristics and their evolution.

- Data analyses will help develop the tectonic and metallogenic model to show the evolution of tectonic features and metallogenic belts during important geological time periods.

- Data analyses will also help create various predictive maps for mineral resources, ecology, and nature-use.

- Besides just information purposes this GIS project will help develop multiple colored maps: geological, geophysical, mineral resources, ecological) providing cartographic and attributive information.

GIS-project is being prepared for publication in both CD and Internet formats. Version GIS in format ArcGIS 9.1 also is accessible on this CD [*Naumova et al.*, 2006b, 2006c].

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